# REVIEW

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WILLIAM A. NOYES, Editor.

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# REVIEW OF AMERICAN CHEMICAL RESEARCH.

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WILLIAM A. NOYES, Editor.




## INORGANIC CHEMISTRY.

**On Some Cuprammonium Sulphates.** BY DAVID W. HORN AND EDYTHA E. TAYLOR. *Am. Chem. J.*, 32, 253–285.—Special attention was given to methods of analysis of cuprammonium sulphates. Sulphates were determined in the presence of copper after removing the latter by adding the acidified solution of the salt to an excess of caustic soda, and filtering. Rose's method of determining copper as cuprous sulphide is shown to give much better results than the electrolytic method. Ammonia is best determined by distillation with sodium hydroxide free from nitrogen. For the determination of water, together with ammonia, a special method was devised. The purity of the salt, $CuSO_4 + 4NH_3 + H_2O$, as made by several methods, was studied. Berzelius' method of precipitating an ammoniacal copper sulphate solution with alcohol and drying the crystals with filter-paper gave a product slightly low in ammonia. A perfectly pure product was obtained by drying over lime. Mallaert's method gives an impure product. The salt obtained by passing ammonia gas into a solution of copper sulphate (Andrae's method), when dried over lime, is perfectly pure. The salt is stable for one year over lime, but the dry salt loses weight in vacuum over sulphuric acid. At 21°-22° 100 grams of water dissolve 18 grams of the salt. The solution has a strong odor of ammonia. A current of air, free from carbon dioxide, passed through an N/10 solution of the salt produces, after a time, a blue crystalline precipitate. The solution of the salt $CuSO_4 + 4NH_3 + H_2O$ also gives a precipitate when highly diluted. When the dry salt stands over potassium hydroxide and strong ammonia it takes up the latter almost to the amount re-

quired by the formula $CuSO_4 + 5NH_3$. Upon heating the tetrammonium salt, water and ammonia are lost. At 100°, 125°, and 149° in dry air the product approaches the composition $CuSO_4 + 2NH_3$. In the presence of water vapor, at 100°, the product, after twelve hours, contains less ammonia than the dihydrate. Experiments were also made at 202° and 260°, giving brown products, which were thought to be mixtures.

H. N. McCoy.

**On the Oxidation of Sulphocyanic Acid and Its Salts by Hydrogen Peroxide.** By J. H. Kastle and C. R. Smith. *Am. Chem. J.*, **32**, 376–385.—Sulphocyanic acid is oxidized by hydrogen peroxide to prussic acid, sulphuric acid and water. The reaction takes place slowly, its progress being easily followed by titration of the acid tormed. Two simultaneous experiments, with different initial concentrations, gave, for the order of the reaction by the application of van't Hoff's formula, 3.27, from which it was concluded that the reaction is of the third order. The velocity of the oxidation at 0° gives a good constant for a third order reaction. At 0° $k = 2.476 \times 10^{-7}$; at 10° $k = 4.64 \times 10^{-7}$. The reaction probably takes place in two stages

(1) $HCNS + 2H_2O_2 \rightarrow HCN + 2H_2O + SO_2$.

(2) $SO_2 + H_2O_2 \rightarrow H_2SO_4$.

Since the second reaction is known to go very rapidly, it is the first which determines the speed of oxidation and, therefore, the order of the reaction. Ammonium, potassium and barium salts are oxidized similarly by hydrogen peroxide. The salts are oxidized more slowly than the free acid. The third order constant for KNCS at 17.5° is $1.03 \times 10^{-7}$. The barium salt is oxidized still more slowly. The speed of oxidation is accelerated by small quantities of many substances, notably by those which have been found to effect the decomposition of hydrogen peroxide. Prominent among these are chrome alum, copper sulphate and nitrate, and ferrous sulphate.

H. N. McCoy.

**A Method for the Determination of Chloric Acid.** By W. S. Hendrixson. *Proc. Iowa Acad. Sci.*, **11**, 147–150.—The chlorate or chloric acid is reduced by iron in 10 per cent. sulphuric acid solution, at room temperature. After the reduction to chloride is complete the ferrous sulphate is oxidized by nitric acid. The ferric salt then serves as the indicator in the titration of the chloride by Volhard's method. Bromates are determined similarly. The results are good. See this Journal, **26**, 747. H. N. McCoy.

**A System of Qualitative Analysis Including Nearly All of the Metallic Elements. Part II. Analysis of the Tungsten Group.** By A. A. Noyes. *Tech. Quart.*, **17**, 214–257. (Part I, *Ibid.*, **16**, 93–131. This *Rev.*, **25**, 445).—The paper constitutes

not only a comprehensive treatise on the above subject, but embodies also the results of much original investigation. Part II deals with the theory and practice of the separation and detection of the elements whose hydroxides, after heating to 120°, are not dissolved by nitric acid, called, for brevity, the Tungsten Group. It includes $SiO_2$, $TiO_2$, $Ta_2O_5$, $Nb_2O_5$, $Sb_2O_5$, $(Bi_2O_5)$, $SnO_2$, $(As_2O_5)$, $(P_2O_5)$, $WO_3$, $(MoO_3)$. The plan of presentation of Part I is adhered to. Special chapters are devoted to a Tabular Outline of the process, General Discussion, Procedure and Notes, Test Analyses, and Confirmatory Experiments and References. The great number of details renders the paper unsuitable for a satisfactory abstract. The author acknowledges his indebtedness to B. E. Schlesinger, D. P. Smith, C. S. Bryan and F. M. Eaton for assistance in the experiments and test analyses.

H. N. McCoy.

**Periodic Literature in Iowa on the Subject of Chemistry.** By W. S. Hendrixson. *Proc. Iowa Acad. Sci.*, 11, 162–164.—The article contains a list of chemical journals available in the state of Iowa, designating the libraries in which each is to be found.

H. N. McCoy.

**On the Action of Sodium Thiosulphate Solutions on Certain Silver Salts.** By W. M. Barr. *Proc. Iowa Acad. Sci.*, 11, 183-190. The solubility of silver iodide in normal and semi-normal sodium thiosulphate was determined at 20°, 25°, 35° and 50°. In normal solution the solubility is a little more than double that in semi-normal. The increase of solubility is nearly proportional to increase of temperature. At 50° marked decomposition occurs. The solubility of silver bromide in thiosulphate is nearly independent of the temperature. Silver iodate and bromate react with sodium thiosulphate solution, so that no solubility determinations could be made.

H. N. McCoy.

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## MINERALOGICAL AND GEOLOGICAL CHEMISTRY.

**Preliminary Report on the Geology of the Arbuckle and Wichita Mountains in Indian Territory and Oklahoma.** By Joseph A. Taft. With an Appendix on **Reported Ore Deposits of the Wichita Mountains.** By H. Foster Bain. *U. S. Geol. Survey, Professional Paper No.* 31, 97 pp.; map, plates.—Chemical data are lacking, except in the appendix by Mr. Bain, which has already been reviewed as a separate publication (this Journal, 26, R 239).

W. F. Hillebrand.

**The Production of Natural Gas in 1903.** By F. H. Oliphant. *Advance Extract Mineral Resources of the United States, 1903*, 37

pp.—Herein are collected analyses made in the present and past years of natural gas from New York and Pennsylvania, Ohio, West Virginia, Indiana, and Kansas. W. F. HILLEBRAND.

**The Production of Steel-Hardening Metals, Including Nickel and Cobalt, Chromium, Tungsten, Molybdenum, Vanadium, Titanium, and Uranium in 1903.** BY J. H. PRATT. *Advance Extract Mineral Resources of the United States, 1903*, 30 pp.—In addition to useful information as to the uses of the above-mentioned metals, analyses are given of ores of nickel, chromium, tungsten and titanium, and of some of the alloys resulting from the employment of tungsten and chromium. W. F. HILLEBRAND.

**A Treatise on Metamorphism.** BY C. R. VAN HISE. *U. S. Geol. Surv., Monograph, No.* **47**, 1286 pp.; plates, figures.—An adequate review here of this colossal treatise is utterly impossible. The subject is handled in the most comprehensive and thorough manner, in a way not hitherto attempted on any such scale. It is "an attempt to reduce the phenomena of metamorphism to order under the principles of physics and chemistry, or more simply, under the laws of energy." As used by the author, metamorphism "means any change in the constitution of any kind of rock." Chapters I to IX treat of metamorphism under the following headings: Introduction, Forces of Metamorphism, Agents of Metamorphism, Zones and Belts of Metamorphism, Minerals, Belt of Weathering, Belt of Cementation, Zone of Anamorphism, Rocks. Chapters X to XII treat of the relations of metamorphism to stratigraphy, to the distribution of the chemical elements, and to ore deposits. To the chemist, as well as to the geologist, this volume offers a wealth of detail and suggestion. Not only are the chemical changes which rock-making minerals undergo, or are supposed to undergo, represented by equations, but the volume changes have been calculated and tabulated. Although the above equations must often be defective or erroneous, the ground for offering them is that a first quantitative approximation to exactness in the alteration of minerals must sometime be made, and that they will surely lead to closer investigations of the nature of the alterations, and hence to improvement in the equations themselves. W. F. HILLEBRAND.

**The Theory of Copper Deposition.** BY ALFRED C. LANE. *Am. Geologist*, **34**, 297–309; figure. A reprint from the Michigan *Miner*, January and February, 1904.—The article relates solely to the copper deposits of Keweenaw Point, and contains a presentation and criticism of views earlier put forward by others, supplemented by the author's own conclusions. As an argument against the theory of deposition by a general circulation of water taken in at the surface, are offered analyses by Dr König of two waters, the one from the relatively shallow Arcadian shaft, the

other from the 46th level of the Quincy. The former is essentially a carbonate water, relatively high in iron and almost devoid of chlorine; the latter, of specific gravity 1.1898, contains chiefly calcium chloride with subordinate sodium chloride and traces of copper and iron. W. F. HILLEBRAND.

**The Porcupine Placer District, Alaska.** BY CHARLES W. WRIGHT. *U. S. Geol. Survey Bull. No.* **236**, 35 pp.; maps, plates.—Contains a few assays of mineralized quartz, slate, etc., from the district named, besides such geological information as brief study permitted. W. F. HILLEBRAND.

**Ueber Die Gegenseitigen Beziehungen Zwischen der Petrographie und Angrenzended Wissenchaften.** BY FERDINAND ZIRKEL. *Jour. Geol.*, **12**, 485–500.—Address presented at the International Congress of Arts and Sciences at St. Louis, September 22, 1904. W. F. HILLEBRAND.

**An Occurrence of Trachyte on the Island of Hawaii.** BY WHITMAN CROSS. *Jour. Geol.*, **12**, 510–523; map.—The rock occurs near the northern base of Mount Hualalai in the form, at one locality, of anhydrous obsidian-like fragments, associated with pumice, which is probably of the same character chemically, and at another neighboring locality as bowlders of felsitic trachyte. An analysis of the obsidian, by the reviewer, showed: $SiO_2$, 62.19; $Al_2O_3$, 17.43; $Fe_2O_3$, 1.65; FeO, 2.64; MgO, 0.40; CaO, 0.86; $Na_2O$, 8.28; $K_2O$, 5.03; $H_2O+$, 0.39; $H_2O-$, 0.14; $CO_2$, 0.02; $TiO_2$, 0.37; $ZrO_2$, 0.04; $P_2O_5$, 0.14; $Cr_2O_3$, trace; MnO, 0.32; BaO, 0.03; $Li_2O$, trace. Total, 99.93. No S, Ni, Sr. In the Quantitative System of Classification the rock falls on the line between nordmarkose and umptekose. On the basis of a partial analysis the trachytoid fragments fall also in the subrang umptekose. "The discovery of this lava rich in alkali feldspar, so far removed petrographically from the basalts and allied rocks hitherto supposed to be the only products of volcanoes on the island of Hawaii, raises primarily a question of much local interest," that is, the connection of these acid eruptives with those of basaltic character. "A broader significance of this discovery is connected with the history of the Hawaiian group." For the discussion of these points reference must be made to the original. W. F. HILLEBRAND.

**Wide-spread Occurrence of Fayalite in Certain Igneous Rocks of Central Wisconsin.** BY SAMUEL WEIDMAN. *Jour. Geol.*, **12**, 551-561; figures.—The fayalite is found in certain phases of the granite-syenite series of rocks constituting a large proportion of the intrusives about the town of Wausau. It is not known to occur in the other varieties of igneous rocks of the region. Six phases of the alkali-rich rocks are represented by analyses made by

W. W. Daniells, namely: Granite, amphibole-granite, hedenbergite-quartz syenite, amphibole syenite, sodalite-nepheline syenite, nepheline syenite. These are not complete, no mention being made of titanium or phosphorus, and fluorine being determined only in one case, though fluorite is reported present in all. Nevertheless, the more important relations are well brought out, and attention is called to the uniformly low content of magnesia, which is regarded as one of the causes of the development of fayalite in the magma. Where the fayalite shows evidences of alteration, this has consisted in removal of silica and formation of magnetite. Fractional separation of the mineral from other constituents of the rock yielded material sufficiently pure to enable Dr. Lenher to establish, by analysis, its normal character.

W. F. HILLEBRAND.

**The Materials and Manufacture of Portland Cement.** BY EDWIN C. ECKEL. *Geol. Survey of Alabama, Bull. No.* **8**, pp. 1–59.—Certain sections of this paper have appeared in slightly different form in the pages of *Municipal Engineering* during the past two years. W. F. HILLEBRAND.

**The Cement Resources of Alabama.** BY EUGENE A. SMITH. *Geol. Survey of Alabama, Bull. No.* **8**, pp. 61–91 ; map, plates.—This report contains many analyses of clays and limestones tabulated according to their geological occurrence.

W. F. HILLEBRAND.

**Index to the Mineral Resources of Alabama.** BY EUGENE A. SMITH AND HENRY McCALLEY. *Geol. Survey of Alabama.* 79 pp.; map, plates.—The chapter on clays and cements contains many analyses from unnamed sources. W. F. HILLEBRAND.

**A Preliminary Report on the Bauxite Deposits of Georgia.** BY THOMAS L. WATSON. *Geol. Survey of Georgia, Bull. No.* **11**, 169 pp.; map, plates.—This report, replete with analyses, contains much matter of general interest relating to the occurrence, composition, and technology of bauxite. W. F. HILLEBRAND.

**Fluor Spar Deposits of the Kentucky-Illinois District. Grades of Ore, Geology of the District, and Genesis of the Ores.** BY H. FOSTER BAIN. *Mines and Minerals*, **25**, 182–183; map.

W. F. HILLEBRAND.

**The Geographic Distribution of Metalliferous Ores within the United States.** BY F. L. RANSOME. *Mining Mag.*, **10**, 7-14; figure.—Its title sufficiently indicates the character of this paper. W. F. HILLEBRAND.

**The Century in Phosphates and Fertilizers. A Sketch of the South Carolina Phosphate Industry.** 71 pp.; portraits. BY

PHILIP E. CHAZAL.—Reprint, with corrections and additions, of a paper prepared for the Centennial Edition of the Charleston *News and Courier* of April 20, 1904, and containing, in addition to historical, descriptive, and other matter of more or less interest, the author's views as to the origin and mode of formation of the phosphate beds. W. F. HILLEBRAND.

**Bibliography and Index of North American Paleontology, Petrology, and Mineralogy for the Year 1903.** BY F. B. WEEKS. *U. S. Geol. Survey, Bull. No.* 240, 243 pp.
W. F. HILLEBRAND.

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## ANALYTICAL CHEMISTRY.

**A New Method of Sampling Copper.** BY R. BAGGALEY. *Metal Industry*, September, 1904.—It is not unusual to find one portion of a pig of blister copper to contain twice as much gold and silver as another part, due to segregation. To obtain accurate samples, the copper is cast as it comes from the converter into plates 17 by 24 by 2 inches, a carload consisting of 240 such plates. Each plate has cast on the bottom 240 small dots from projecting buttons on the mold, and each plate in succession is drilled through at one of these dots, each plate at a different dot. The united drillings represent 240 different plates, each drilled at a different hole, and thus giving a reliable average sample of the lot. J. W. RICHARDS.

**Assay of Cyanide Solutions.** BY M. LINDEMAN. *Eng. Min. J.*, July 7, 1904.—Ten assay tons of solution are made hot and ammoniacal copper nitrate added until the solution is permanently blue. Sulphuric acid is then added carefully, in excess, the solution stirred and filtered. The paper is folded, carbonized in a scorifier, transferred to a crucible, fused with test lead and cupelled. The method checks very well with evaporation with litharge, at least on 0.02 per cent. cyanide solution carrying up to $3 worth of gold per ton. J. W. RICHARDS.

**Assay of Nickel Ores.** BY A. M. FAIRLIE. *Eng. Min. J.*, July 7, 1904.—The following method has been successfully used for analyzing German-silver and could be readily adapted to nickel ores containing copper and zinc. Dissolve in nitric acid, make ammoniacal and barely acidify with sulphuric acid; heat to about 90°; add 10 cc. sulphurous acid solution and 2 grams ammonium sulphocyanate. The copper is precipitated as white sulphocyanate. Filter out, wash and determine copper in the usual way. The filtrate is made ammoniacal and faintly acidified with citric, or preferably, formic acid, and hydrogen sulphide passed in the cold for

about ten minutes. Zinc sulphide precipitates white, free from nickel. Filter and determine zinc by any usual method. The filtrate is boiled with nitric acid, any free sulphur filtered off, then ammonia added and the silver iodide indicator, and is ready for titration of the nickel by potassium cyanide. J. W. RICHARDS.

**Aniline Colors and Salicylic Acid in Articles of Food and Drink.** BY C. H. LAWALL. *Am. J. Pharm.*, 76, 477.—Prohibited ingredients of foods are not necessarily injurious to health, but by their use inferior products are fraudulently so manipulated as to enaole the seller to obtain the price of a superior class of goods. So much has been written and said against salicylic acid that many regard it as being nearly as toxic as arsenic. Such persons might be surprised to learn that an ordinary wintergreen lozenge contains as much salicylic acid, combined as methyl salicylate, as does an average tumbler of jelly.

The range of aniline dyes used to color food products is not extensive, comprising only the red, yellow and brown, and occasionally green and blue. Directions are given by the author for the detection of artificial colors by boiling with white woolen cloth, and for the detection of salicylic acid. W. H. BLOME.

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## METALLURGICAL CHEMISTRY AND ASSAYING.

**Change of Structure in the Solid State.** BY W. CAMPBELL. *J. Franklin Inst.*, September, 1904.—These changes are classified as (1) of structure, due to mechanical stress and the growth of crystals on annealing the metal or alloy thus strained; (2) of composition, caused by diffusion, such as carburization (cementation, case-hardening), decarburization or change of state of the carbon, or passage of one metal into another, as gold into lead, or internal oxidation, as the burning of steel or oxidation of copper; (3) transformations taking place in metals or alloys below their melting-points as temperature changes, such as the allotropic changes in iron or changes in alloys below their melting-points. An extended discussion then follows of the alloys of aluminium and copper, copper and tin, iron and carbon, accompanied by 32 beautiful microphotographs. J. W. RICHARDS.

**Notes on Metallography.** BY W. CAMPBELL. *School of Mines Quarterly*, July, 1904.—An elementary presentation of the subject, giving in clear language such information as a beginner in the subject would need. J. W. RICHARDS.

**Pyritic Smelting. A Review, X, XI.** BY E. D. PETERS. *Eng. Min. J.*, August 4 and 11, 1904.—Concerning the relative capacity and economy of the pyritic smelting furnace, there will

be little oxidizing effect and little concentration until the silica in the charge is sufficient in amount to (*a*) form a bisilicate with the lime and magnesia; (*b*) form uni-silicate with any oxidized iron or manganese in the charge; (*c*) form uni-silicate with the ferrous oxide produced in the furnace when oxidizing enough iron sulphide to make matte of the desired grade. It is this excess of silica which is required which slows-up the pyritic smelting operation. The operation can be hastened only by increasing the blast pressure and volume of blast, and with this increase it will give as large an output as if doing ordinary smelting. Burning pyrites is a more delicate operation than burning coke, closer supervision is needed and furnace campaigns are usually shorter.

The following is a summary of the advantages and disadvantages of pyritic smelting of heavy pyritic ores: *Advantages,* (1) No roasting required; (2) great saving in coke; (3) more silica can be used in the charge; (4) more complete elimination of Pb, As and Sb; (5) heavy spar less objectionable. *Disadvantages,* (1) heavier blast; (2) greater care and skill in management; (3) shorter campaigns; (4) possible reconcentration of matte required; (5) zinc more injurious than in a roasted charge; (6) sulphur fumes necessarily wasted. Local conditions must decide in each case which method of smelting is most profitable.

J. W. RICHARDS.

**Pyrite Smelting.** BY H. LANG. *Eng. Min. J.*, September 22, 1904.—An appendix to the general discussion of this subject (see this *Rev.*, **26**, 417) which has been reviewed by Dr. Peters. As a definition, to differentiate from ordinary matte smelting, the following is given: "Pyrite smelting is that department of blast-furnace smelting in which metallic oxides are formed in the furnace." There should have been added "by the oxidation of metallic sulphides." These reactions furnish the heat necessary for running the furnace. The heat-making, matte-making and slag-making are practically simultaneous and one reaction. The writer's view is that the essential reaction in the furnace is $2FeS + SiO_2 + O_2 = 2FeO.SiO_2 + S_2$. The sulphur burns to $SO_2$, if there is sufficient free oxygen to burn it; if not, it will escape; generally it passes off in both conditions. In the presence of carbonic acid gas, instead of free oxygen, the oxygen required in the above equation is furnished by the reduction of $2CO_2$ to $2CO$. The further suggestion is made that the pyritic furnaces of the future may be reproductions of modern iron blast-frunaces, with height diminished, but with all other accessories. J. W. RICHARDS.

**The Production of Iron Ore in 1903.** BY J. BIRKINBINE. *Iron Age*, August 11, 1904 (from report U. S. Geological Survey). —The total production in the United States was 35,019,308 long tons, of which 15,371,396 tons were mined in Minnesota, 10,600,-

330 tons in Michigan, and 3,684,960 tons in Alabama. The total value was $66,328,415, being $1.89 per ton. The basic price of Lake Superior Bessemer ores was $4.50 per long ton at the lower lake ports, when containing 63 per cent. iron, 0.045 phosphorus and 10 per cent. of moisture, when dried at 100° C.

J. W. RICHARDS.

**Pig Iron Production in 1904.** *Eng. Min. J.*, August 4, 1904 (from Bulletin American Iron and Steel Association).—The estimated output of the United States for the first half of 1904 is 8,173,438 tons, of which 55 per cent. was Bessemer iron, 30 per cent. foundry and forge iron, 13 per cent. basic iron and 1.4 per cent. spiegel and ferro-manganese. Ninety per cent. was made by using coke, or coke with some bituminous coal, 7.4 per cent. using coke and anthracite, 0.2 per cent. using anthracite alone and 2.6 per cent. using charcoal.

J. W. RICHARDS.

**Mesabi Ores in Coke Blast Furnace Practice.** BY W. A. BARROWS. *Iron and Mach. World*, June 25, 1904 (from *American Manufacturer*).—Large proportions of fine Mesabi ore can be worked in the blast-furnace, if care is taken on the following points: (1) Adjusting the furnace top and lines to the ore mixture used. (2) Proper placing of stock in the bell and lowering into the furnace. (3) Ample space allowed for the slow explosions to take place in, and bolting the hopper at least 15 feet down into the top of the furnace. (4) The blast should be off as little as possible, because long stops are particularly liable to cause slips. (5) Increasing the amount of slag produced until it is 1,300 to 1,350 pounds per ton of pig iron, and using dolomite as part of the flux. (6) Keeping the furnace working hot and making gray iron, because the quantity of dust invariably increases as the furnace works cold and the gases become thin. (7) Having sufficient engine, stove and boiler capacity to enable the manager to "run" the furnace instead of having the furnace "run" him.

J. W. RICHARDS.

**Modern Blast-furnace Construction.** BY I. G. BAYLEY. *Iron Age*, September 29, 1904.—The drawing office makes first the general plan on a scale of $^1/_{10}$ inch per foot, showing the furnaces, stoves, boilers, tracks, gas and air piping, stock bins and building foundations. This is blue-printed and distributed to the draughtsmen for detailed drawings. The latter are classed into 100 sheets, with very practical notes given as to the nature of each drawing. In conclusion, it is stated that the use of gas engines and electrical power have reduced the number of drawings necessary for a complete blast-furnace plant by one-half. As far as possible, all detail drawings should be on the same scale and of one size. Much time can often be saved by making drawings di-

rectly on the back or wrong side of tracing linen. All drawings, tracings and blue-prints should be carefully numbered and indexed. A good checker is indispensable. J. W. Richards.

**Wandering of Blast in Furnaces.** By T. F. Witherbee. *Iron Age*, September 22, 1904 (read before American Institute of Mining Engineers).—Blast-furnaces 85 feet high by 18 feet bosh have shown themselves to combine high output with small fuel consumption, while an increase of bosh to 19 or 20 feet, and of height to 90 or 100 feet, while giving increased output, has always resulted in higher coke consumption and less regularity of working. It is quite possible that the cause of this is the "wandering" of the blast, that uneven distribution of the blast through the large tuyere areas causes increased resistance, higher pressure and irregular distribution of the blast, with its attendant disadvantages. Irregular distribution of solid charges will accentuate this trouble; the remedy for this is improved charging apparatus, charging nearer the center, so as to have a more resistant column of materials to blow against, thereby enabling enough reduction of the tuyere area to minimize blast wandering and its train of evils. At present, with large bells, the tuyeres are 50 to 60 per cent. too large, and thus control of the blast and its regular distribution is lost. J. W. Richards.

**The Hartman-Kennedy Fire-Brick Stove.** By J. M. Hartman and J. S. Kennedy. *Iron Age*, August 18, 1904.—The stoves are provided with an external combustion chamber, which is a horizontal cylinder 12 feet long by 5 feet in diameter, and connected with the stove proper by two 30-inch necks. These chambers produce perfect combustion of the gas before it enters the stoves, flue dust is deposited where it can be readily blown out, and any fused or clinkered material can be easily removed. They also provide additional heating surface and allow for additional regenerative space in the stove itself. The stoves proper are of the two-pass type, with a heavy 18-inch partition between, are 19 feet in diameter by 76 feet high, and a set of three contains 106,500 square feet of heating surface. These will heat steadily 22,000 cubic feet of air per minute to 1200° F. when used with an equalizer. The latter is the first to be erected in America, and is 12 feet 6 inches in diameter by 19 feet 9 inches high, with two passes for blast, and filled with 2 x 2-inch passages with 1.5-inch walls. Pyrometers placed before and behind the equalizer show a varying temperature converted into a perfectly even one.

J. W. Richards.

**Titaniferous Iron Ores.** By N. P. Hulst. *Eng. Min. J.*, September 1, 1904 (read before Lake Superior Mining Institute).—In titaniferous magnetite the titaniferous material is so intimately

mixed with the magnetite, more or less free from titanium, that very fine crushing is necessary before magnetic separation can make a satisfactory separation, which would render subsequent briquetting necessary. The smelting of iron ores high in titanium produces thick, ropy slag, while accretions of infusible titanium compounds choke the crucible. Rossi has concluded that perfectly fusible slags can be made containing 30 to 35 per cent. of $TiO_2$, only 15 per cent. of $SiO_2$, with alumina, lime and magnesia as bases, but while these results were obtained eight years ago with a small furnace, no modern large furnace has attempted to duplicate them.

J. W. RICHARDS.

**Some First Principles of Electrical Resistance Furnaces.** BY F. A. J. FITZGERALD. *Electrochem. Ind.*, September, 1904.—In almost all early work with the electric furnace the arc was used, but in recent years the tendency in industrial work has been towards resistance furnaces. These are of two kinds, those in which the material being treated itself conducts the current, and those in which this material is heated by radiation or conduction from an electrically-heated resistance body. In studying the principles of such furnaces we must, therefore, consider both the generation of heat by resistance and the distribution of such heat. Of the heat generated, part is used in heating up the resistance and part is radiated or conducted away, the latter part increasing as the resistance attains its maximum temperature, until finally all the heat is radiated or conducted. For a given material surrounding a resistance in which heat is generated, the maximum temperature of the resistance will vary with its area of contact surface with the surrounding material, or, the watts absorbed will be proportional to the surface of the resistance body, or watts $\div$ surface $=$ a constant, which may be determined experimentally for any operation employing an internal resistance and external surrounding material. This constant being known, can then be used in designing the size of larger or smaller furnaces. In furnaces where the material itself is heated by its own resistance, the current must supply a certain amount of heat to bring it up to the temperature desired, which requires a definite number of watts per unit of volume. When this requirement has been once obtained for a certain material, calculations for any volume or weight can be made. In such processes the mass to be heated should be of such form as to expose as small a surface to radiation as possible, consistent with the electrical requirements, and should be heated as rapidly as possible so as to diminish the total losses by radiation. The necessity of efficient heat insulation is greater than in other furnaces, because of the high temperatures and the expense of electric current. In all electric furnace work a careful account should be kept of the energy used and output obtained, and

by experimenting intelligently with various forms of furnaces and methods of charging the most efficient practice can be evolved.

J. W. RICHARDS.

**The Manufacture of Iron by Electrometallurgical Processes.** BY A. MINET. *Eng. Mag.*, August, 1904.—A carefully written and well illustrated review of this subject to date. The only American process mentioned is that of Ruthenburg, and nothing new is given regarding it. The calculations of the power theoretically required are interesting. J. W. RICHARDS.

**The Manufacture of Ferro-alloys in the Electric Furnace.** BY G. P. SCHOLL. *Electrochem. Ind.*, September, October, November, 1904.—A comprehensive review of the furnaces and processes of Hércult, Keller, Rossi, Kerr, etc. *Ferro-silicon* is produced in Europe by fifteen establishments, either by reducing low-grade iron ores in vertical shaft furnaces, or reducing silica sand by carbon in the presence of metallic iron, or by using an impure carbon containing much silica ash in the manufacture of calcium carbide and adding iron or iron ore to the charge, thus producing the ferro-silicon as a by-product. At Kanawa Falls, W. Va., the Willson Aluminum Co. use iron ore, river sand and coke, producing an alloy with 28 per cent. silicon, and using 5930 kilowatt-hours per ton. Keller, in France, claims to produce a ton of 30 per cent. alloy with 3500 kilowatt-hours, but the latter used metallic iron. Theoretically, there is required for Keller's operation, per ton of product, 2,315,289 calories, equal to about 2730 kilowatt-hours, while for the Willson furnace operation there is required 3,066,264 calories, or 3565 kilowatt-hours; that is, Keller actually uses 28 per cent. more power than the net heat absorption in his furnace requires, and Willson 66 per cent. more, or Keller's operation is 23 per cent. more economically conducted.

J. W. RICHARDS.

**Alloys Used for Steel-making.** BY J. OHLY. *Mines and Minerals*, August, 1904 (continued from December, 1903).—*Ferro-titanium* containing 25 per cent. of titanium and 0.40 per cent. carbon can now be bought at 90 cents per pound, and is useful in steel-making for absorbing dissolved nitrogen from the steel, titanium nitride, $TiN_2$, rising into the slag. *Ferro-vanadium* is made from vanadiferous ore by first preparing a compound containing some 18 per cent. of $V_2O_5$ and 78 per cent. $Fe_2O_3$, which is then dried, mixed with twice its weight of carbon and an equal weight of aluminium in small pieces, and fusing by the electric arc in a graphite crucible. The metallic button obtained contains 16 per cent. of vanadium, 60 per cent. of iron, 12 per cent. of silicon and 12 per cent. of aluminium and carbon. Introduced into steel the vanadium unites with nitrogen and increases the strength

and ductility. *Ferro-boron* also removes nitrogen from melted steel, and improves its quality. *Ferro-uranium* is made by charging an electric furnace with pitchblende and carbon, giving uranium carbide. This readily unites with steel, the uranium forming no compound with nitrogen, but making a direct alloy with the steel. *Ferro-aluminium* contains usually 10 per cent. aluminium, and is added from 5 to 12 pounds per ton to melted steel to remove dissolved oxygen and produce sound castings. As much as 2,500 tons of aluminium are thus used yearly in the United States alone. *Ferro-sodium* contains about 25 per cent. of sodium and is sold as powder. Its action on melted steel is similar to aluminium, producing a very clean, well-fluxed metal. *Ferro-silicon* carries 21 to 22 per cent. of silicon, and sells at about $40 per ton. It is produced by heating in an electric furnace 1000 parts scrap iron, 400 parts quartz sand and 390 parts coke. It acts on steel similarly to aluminium, producing a very dead-melted metal. Silicon copper is used only in casting copper, brass and bronze. It contains 15 per cent. of silicon, and 0.25 to 0.5 per cent. is added, producing a metal free from blow-holes and flaws. It sells at 34 cents per pound. J. W. RICHARDS.

**Production of Iron Sows in Pyritic Smelting.** BY C. H. FULTON. *Eng. Min. J.*, September 1, 1904.—The writer thinks it highly improbable that the iron is formed by the reducing action of carbon on FeS, since the atmosphere of the furnace is not reducing, and no carbon is found in the reduced iron. He thinks it much more probable that part of the FeS is oxidized to FeO and $SO_2$, and that there is then a reaction between FeO and unoxidized FeS, forming $SO_2$ and Fe in just the same manner as Cu is formed from $Cu_2S$ in the second half of the blow in Bessemerizing copper matte. This theory of the formation of iron sows in pyritic smelting will explain all the observed phenomena.

J. W. RICHARDS.

**Iron Casting Plant of the International Harvester Co.** *Iron Age*, September 1 and 8, 1904.—A long, well-illustrated description of a new, modern foundry, producing malleable castings on a very large scale. There are 22 tumbling mills in which the brittleness of the castings is first removed by tumbling, and which are provided with exhaust fan connections for removing dust. There are twelve annealing ovens of the horizontal type, 35 feet long by 10 wide, inside, into which the annealing boxes are placed by an overhead crane, which lifts off a section of the curved roof for that purpose. The furnaces are fired by coal dust and a hot-air blast, the latter obtained by passing the blast supply pipe for the furnaces through the entire length of the main flue. The ash of the coal is deposited largely in the furnace itself, and is cleaned out at the end of each heat. No ash is deposited on the

sides of the annealing pots, and the little settling on top of them does no harm. J. W. Richards.

**The Porteous Portable Melting Furnace.** *Iron Age*, September 22, 1904.—This furnace is of the revolving barrel type, is intended particularly for melting brass, copper, zinc, aluminium, tin, lead, steel, cast iron and malleable iron, and dispenses with crucibles, ladles, and coke or coal. The fuel is oil or gas. The furnace is made in three sizes, of 300, 600 and 1,000 pounds. Linings stand 300 to 400 heats, and the cost is one-quarter that of melting in crucibles. The oil or gas injection apparatus are semi-portable, while the furnace proper is mounted on ball-bearing wheels, and after the metal is melted, in position against the fuel injector, the supply of fuel is cut off and the furnace wheeled to where the metal is to be poured. J. W. Richards.

**The Copper Mines of Shasta County, Cal.** By D. E. Woodbridge. *Iron Age*, August 11, 1904.—The mineral output of these mines is over double that of any other county in California, and over half the silver mined in the state comes from these mines as a by-product. The Iron Mountain ore body is an almost solid mass of sulphides in lenticular lenses about 600 feet long, 100 to 400 feet wide, and 500 feet deep. The smelter contains 11 turret roasters of the McDougall type, five water-jacketted hot-blast furnaces, and three matte Bessemers. In the converters, quartzose gold ore is used for lining. The ore averages 5 to 6 per cent. copper, and is concentrated by the first smelting to a 20 per cent. matte, and by the second to a 50 per cent. matte, which is then blown to blister copper, which is shipped for refining to Elizabeth, N. J. The coke used comes from Australia, and costs $12 to $13 per ton. The output in 24,000,000 pounds of blister copper yearly.
J. W. Richards.

**The Greene Consolidated Copper Company.** By D. E. Woodbridge. *Iron Age*, August 25, 1904.—These mines and works were opened only four years ago. Lenses of rich smelting ores 80 or 90 feet in length by 400 feet long are found, while copper has penetrated the surrounding rock for a distance, at times, of 100 to 150 feet, to a tenor of 3 to 5 per cent. of copper. Most of the workings are in soft chalcocite, but cuprite and black oxide are mined in considerable quantity. The output will be shortly 3000 tons of ore daily. The smelting capacity is being increased, and the output is now close to 70,000,000 pounds a year. There are eight Mitchell hot-blast furnaces, the largest 54 by 160 inches in section. The matte and slag run continuously into 30-ton detached settlers, and from these the matte is tapped into ladles and carried by overhead cranes to the converters. There are five barrel-shaped

converters. Pneumatic rammers are used for tamping in the linings. J. W. RICHARDS.

**Foundry Practice with Copper and Its Alloys.** BY W. J. REARDON. *Metal Industry*, June, 1904.—Pure copper can be successfully cast by heating it just hot enough to pour into the mould, using sand of just the right temper, or moistness, keeping the metal covered, never letting it stand in the furnace when once ready, and adding a small amount of silicon copper. Practical directions are given for making and casting bronzes and brasses, and taking care of moulding sand. J. W. RICHARDS.

**The Washoe Smelter at Anaconda.** BY C. S. PALMER. *Eng. Min. J.*, September 22, 1904.—A very readable, general description of this immense works, which handles 5,000 tons of ore a day. Among the observations worth notice are, that the flue dust from the main flue contains 5 to 20 per cent. of arsenious oxide and is now being treated by a small roasting plant with the object of extracting the arsenic. The copper slag from the blast-furnaces is said to average 40 per cent. silica, 20 per cent. lime, 27 per cent. iron, about 0.3 per cent. of copper, and the matte 39 per cent. to 44 per cent. of copper. The reverberatories are being enlarged, each set of two being replaced by one furnace 80 to 100 feet long, with Sterling boilers, at the flue ends to save heat, thus raising almost all the steam required about the plant. The blister copper from the Bessemers is refined and poled to 99.6 per cent. fineness before being cast into anodes and these are now being shipped east for electrolytic refining. J. W. RICHARDS.

**Dust Chamber Design.** BY M. J. WELCH. *Eng Min. J.*, September 1, 1904.—The object of collecting flue dust is (1) profit, (2) avoidance of lawsuits, (3) cleanliness. Modern practice has dispensed with brick, stone, and iron bracing, and substituted a skeleton of steel, expanded metal and cement. Illustrations and description are given of flues so constructed at the Arkansas Valley Smelter in Colorado. Near the blast-furnaces, in both copper and lead smelting, the gases are hot and dry, and there concrete, brick stone or steel can be safely used. Steel work embedded in concrete should never be painted, but exposed steel should be painted with graphite paint. The acid-proof materials, used where the gases are cool, are brick, adobe mortar, fire-clay and acid-proof paint. The corrugated iron used for the roof is painted underneath with graphite paint and covered on top with tamped concrete.

J. W. RICHARDS.

**Chloridizing Roasting of Silver Ores in Mexico.** BY E. STEIN. *Eng. Min. J.*, September 1, 1904.—A description of present methods, using hand reverberatories and revolving White-Howell furnaces. The former are 7 feet wide by 14 feet long, if dry ore is

roasted, but 20 to 40 feet long for wet ore, to allow space for drying. The loss of silver by volatilization amounts to 4 to 15 per cent. of the silver present. Nearly all modern mills have ore-pits, in which the hot roasted ore rests twelve to twenty-four hours, for supplementary chlorination, thus increasing the capacity of the furnaces and the per cent. of silver chloridized. Each furnace roasts 1200-pound charges in about two hours, or 9.6 tons per day, at a cost of $0.85 for labor, $2.40 for salt (4 per cent. of weight of ore at $60 per ton), and $0.90 for wood; a total of $4.08 per ton.

J. W. RICHARDS.

**Present Practice in Cyanidation in the Black Hills** BY W. MAGENAU. *Eng. Min. J.*, August 11 and 18, 1904.—A compilation in tabular form of the equipment and metallurgical practice in eleven large plants. The capacities of these mills run from 70 to 2160 tons daily; cone classifiers are generally used; the sands are from 1 to 4 times the weight of the slimes; the sands are treated in tanks holding 100 to 600 tons, the time of treatment eighty to three hundred and eighty-four hours, 0.4 to 14 tons of solution being used per ton of sands, the strength being 1.2 lbs. to 7.0 lbs. of potassium cyanide per ton of solution; the slimes are treated in tanks of very varying size, the time being ninety-six to one hundred and eighty hours, 3 to 11 tons of solution being used per ton of slimes. The precipitation is effected by zinc dust in the largest plant, with two 24-frame 36-inch-square filter presses; in the others zinc shavings are used, using 0.35 to 2.4 cubic feet of zinc shavings per ton of material treated per day, or 0.35 to 1.20 cubic feet per ton of solution to be precipitated per day, and using up 0.20 to 0.92 pound of zinc per ton of solution treated, or, in another way, 0.25 to 3.3 pounds per ounce of bullion produced. There is consumed in these mills 0.35 to 1.0 pound of potassium cyanide per ton of ore treated, and 3 to 9 pounds of burnt lime. The gold value of the solutions treated runs from $1.75 to $20.00 per ton of solution, the value after treatment $0.02 to $0.16 per ton; the dry precipitate from the zinc treatment contains 7 to 50 per cent. of its weight of gold and silver, and the bullion varies from pure gold to equal parts of gold and silver. As to costs, the Homestake mill crushes and amalgamates 4,000 tons of $4 schistose gold ore per day, for 40 cents per ton, and cyanides 2,150 tons of sands and slimes daily for 30 cents per ton; the average cost of these two operations at other mills is $1.25 to $1.50 per ton; the extractions vary from 70 to 80 per cent. J. W. RICHARDS.

**Ormolu Gold Finish.** BY F. P. DAVIS. *Metal Industry*, June, 1904.—The fine yellow finish is placed on art-objects made of ormolu metal, *viz.*, copper 58, zinc 25 and tin 17 parts, which itself has a golden yellow color and forms an excellent base for gilding For cheapness, the articles are now cast in zinc, the surface buffed

to a fine polish, and then plated with brass, so as to give it a matte of golden yellow color. The bronze articles are given a matte surface by dipping in a hot solution containing nitric acid 200, sulphuric acid 100, common salt 1, sulphate of zinc 1 to 5 parts. The article is left in until action on it and bubbling cease, being held stationary. It is then rinsed quickly, and dipped into a bath composed of nitric acid 5 gallons, sulphuric acid 5 gallons, common salt 2 handfuls. This solution is used cold, and the article rinsed carefully, being dried finally in alcohol, if the finest finish is desired. The addition of 1 or 2 ounces of arsenious oxide to the last bath gives a bright sparkling matte. It is then put at once into the cyanide gold-plating bath, and plated with gold alloy as nearly as possible the color of the article. If reddish gold-plating is desired, some cyanide of copper is added to the solution, and the bath kept hot. Straw-tinting is obtained by adding silver cyanide and running cold. Only enough gold need be put on to protect the matte surface from oxidation. The articles are rinsed, dried in alcohol and given a coat of lacquer. J. W. RICHARDS.

**Distillation of Zinc from Cyanide Precipitate.** BY G. H. CLEVENGER. *Eng. Min. J.*, September 22, 1904 (read before American Institute of Mining Engineers).—Of present methods of refining these precipitates smelting with lead after removal of zinc is the best. It is possible to remove the zinc more completely and at less cost by distillation than by acid treatment. A proposed new method of carrying this out is to mix the dried precipitate with finely divided lead and charcoal, and then retort it. If mercury is present, it distils off first; the zinc is best condensed as dust, using large condensers, and is thus ready for re-use as a precipitant. The residue is cupelled in a proper furnace. The operation outlined is somewhat analogous to the distillation of leady-zinc crusts in the Parkes process, but there must be charcoal enough and heat enough to reduce the zinc oxide in the precipitates. In experiments, the first zinc distilled over at 671° C., at 866°, thirty minutes after commencing, 9.2 per cent. of the zinc had distilled over, at 1055°, one hour, 16.1 per cent., and thereafter increasing rapidly with increasing temperature until at 1225°, three hours and thirty minutes from starting, 95.4 per cent. of the zinc had distilled; at the end of five hours, temperature then 1281°, 99.1 per cent. had distilled,—in another experiment 99.6 per cent. at a final temperature of 1296°. The volatilization of gold and silver is small, and not of importance, since the zinc is used over. The residue pours from the retort like sand, without sticking, is then smelted with lead, iron ore and silica on the hearth of a small reverberatory furnace, and the rich lead afterwards cupelled. J. W. RICHARDS.

**Electrolytic Production of Zinc and Lead from Complex Sulphide Ores.** BY C. H. BURLEIGH. *Electrochem. Ind.*, Sep-

tember, 1904.—Refractory zinc sulphides may be classed into those containing lead, gold, copper or silver, with 7 to 12 or more per cent. of zinc, and which cannot for that reason be profitably smelted, and those which are very high in zinc, but cannot be profitably distilled because of their iron, lead, copper, etc. When the blende crystals are large, mechanical separation can often be profitably employed; when they are small and intimately intermixed, these methods are inapplicable. The method proposed by the author consists in crushing, roasting, extracting, filtering, plating out lead, plating out zinc. The ore is crushed to between 8 and 40 mesh, the roasting is conducted so as to leave no sulphate in it, but to have as much oxide as possible, and any sulphur remaining as sulphide rather than sulphate. The roasted ore is extracted with a hot 25 to 40 per cent. solution of soda, kept stirred, time 4 to 12 hours; all the lead and 80 to 95 per cent. of the zinc go into solution. The solution is filtered in a filter-press, and the residue, containing iron, gold, silver copper and gangue, with some zinc, well washed. The residues may be treated by cyaniding or smelting. The solution is run into electrolytic tanks, where, with voltage kept at 1.5 to 1.7, the lead is plated out pure. The lead sponge is pressed until nearly dry and melted down. The solution passes to other electrolytic tanks, where, by using over 2.5 volts and over 10 amperes current density per square foot, the zinc is plated out on cathodes of 6 square feet area, to a thickness of about 1 inch. The ampere efficiency of deposition is 90 to 95 per cent. Carbon makes the best anode and zinc the best cathode. If spongy zinc is first deposited on the cathode, and on top of this the reguline metal, the sheets of the latter can be readily stripped off, and the cathode plate replaced. Spongy deposits of zinc are not due, in the author's opinion, to evolution of hydrogen, but to the presence of iron in the solution, particles of which deposit on the zinc, form couples by local action and disintegrate the zinc in their neighborhood. Iron must be kept out of the solution by proper roasting of the ore. There must also be at least 30 grams of zinc per liter of solution to plate out well; the rich solution contains about 100 grams, and when exhausted to 30 grams it is returned to the leaching tanks. The cost of treatment varies between $5 and $15 per ton, averaging $8. These statements have been confirmed by work on a commercial scale. J. W. Richards.

**Cadmium in Commercial Zinc.** *Metal Industry*, September, 1904.—While cadmium may be considered as an impurity in spelter, yet, when the latter is used in making brass, 0.5 per cent. of cadmium in the brass would not show any deleterious effects, except a slight hardening. In casting brass cadmium is rather an advantage, acting as a deoxidizer. J. W. Richards.

**Manufacture of Zinc Foil.** *Metal Industry*, September, 1904.—Pure zinc, such as "Bertha" spelter, may be rolled into sheets only 0.00025 inch thick. Starting with sheet about 0.025 inch thick, a piece 16 inches square is rolled till it is 24 inches long, then cut in half, and the two sheets of 12 by 16 inches laid on one another and folded in the middle. This is rolled, the folded end being first put into the rolls, until it is 12 by 12 inches. This has the closed end clipped, and is then folded again and rolled; the operations are repeated until the sheets are about 0.002 inch thick. The object of this method is to insure that the sheets pass through the rolls each successive time, in a direction at right angles to the previous passage, so as to avoid fiber. The rolling is preferably done at 100° C. To roll down to thinner foil four pieces of sheet zinc, 12 by 18 inches, and 0.025 inch thick, are laid on each other and bent in the middle into a book 12 by 9 inches. Between each of these leaves are placed two of the thin sheets 0.002 inch thick and 12 by 9 inches in size. The closed end of the packet is then presented to the rolls, and it is rolled until 12 by 13.5 inches. The free edges are then trimmed, the fold sheared off, the package folded the other way, and re-rolled. These operations are repeated until sheets only 0.00025 inch thick are obtained. The foil is used in place of tin-foil, for wrapping soap, tobacco, cigars, etc., being less expensive. J. W. RICHARDS.

**Manufacture of Chromium.** BY A. K. EATON. *Metal Industry*, August, 1904.—A mixture of 131.6 pounds of sodium bichromate and 143.2 pounds of zinc sulphate is subjected to a red heat, forming zinc chromite and sodium sulphate. The latter is removed by boiling water, leaving the former as a gray powder, which is mixed with 20 per cent. of its weight of very finely powdered carbon, the mass moistened with molasses and compressed strongly into compact cakes. These are heated until the zinc distils off, leaving metallic chromium as a compact cake.

J. W. RICHARDS.

**The Quicksilver Deposits of California.** BY W. FORSTNER. *Eng. Min. J.*, September 8 and 15, 1904.—Mercuric sulphide is not found intimately associated with sulphides of lead, zinc or iron, as is sulphide of silver, nor does it form sulpharsenites, sulphantimonites or chlorides in the zone of oxidation; furthermore, it is volatile at about 237° C., which would explain its volatilization by subterranean heat at small depths. It is soluble in solutions of alkaline sulphides, forming double sulphides, and is precipitated from solution by sulphur waters. In California, mercury deposits are undoubtedly related to igneous phenomena. The presence of a small amount of metallic mercury in all cinnabar deposits is due to sudden precipitation or dilution of the solution (as proved by Prof. Christy), similarly to the production of red

powdered copper when cuprous sulphate is acted on by water and cupric sulphate formed. J. W. RICHARDS.

**Platinum in Old Channel Placers.** BY D. H. STOVALL. *Mines and Minerals*, August, 1904.—Platinum occurs in such deposits in some quantity, particularly in Southern Oregon. It occurs as coarse, black powder near bed-rock. It is saved in the sluices by a system of undercurrents on a broad riffle table, where it spreads over a coco-mat riffle. The platinum concentrates settle in the matte, and are obtained by washing it out in tanks. The platinum sands resemble coarse, black gunpowder, and contain platinum, both free and combined, as well as some rhodium, osmium, iridium and palladium. J. W. RICHARDS.

**Notes on the Tungsten Deposits of Arizona.** BY F. RICKARD. *Eng. Min. J.*, August 18, 1904.—The deposits occur in the Little Dragoon mountains, Cochise County, and contain hübnerite, wolframite and scheelite. The ore deposit is one in which the feldspar of granite has been replaced by the tungsten mineral, pseudomorphs after feldspar being found. Some rich pockets of nearly pure hübnerite, weighing several tons, have been found. Ore containing 68 per cent. of tungstic oxide is worth $22.75 per pound. The deposits and the mining are, so far, only superficial. Some gulch placer deposits have been worked, and wolframite sand extracted by rockers, sluices and hand jigs. Some 18 tons of ore were sent to a gold milling plant for treatment, but the tailings carried over 20 per cent. of tungstic oxide, representing a loss of over one-third of all the tungsten present. The concentrates used to sell for $2.50 to $3.25 per unit, 65 per cent. tungstic oxide being the minimum allowable, but recently as high as $6 per unit has been paid, or $420 per ton for 70 per cent. ore.

J. W. RICHARDS.

**The Manufacture of Sodium by the Becker Process.** BY C. F. CARRIER, JR. *Electrochem. Ind.*, September, 1904.—Since Becker proposes the electrolysis of a mixture of caustic soda with sodium carbonate to reduce its melting-point, experiments were made to examine the course of the operation. Carbonate up to 60 per cent. of the weight of the bath was used, working from temperatures of 255° to 550°, but no carbonic acid was given off in any case, even when electrolysis was carried on for six hours. The yield of sodium is greatest close to the melting-points of the mixtures, though the best yield decreases as the carbonate increases. Very little sodium was obtainable from mixtures with 50 to 60 per cent. of carbonate, at the high temperatures of 550° to 630° necessary to keep them fluid. Electrolysis of a mixture with 38.8 per cent. of carbonate at 300° gave yields of 95 and 96 per cent., but with 52.7 per cent. carbonate at 500° only 39 and

41 per cent. yield. The current densities used were not above 2.5 amperes per square centimeter. The conclusion is that no carbonate is decomposed, thus negativing Becker's claims. A supplementary experiment showed that in aqueous solutions also, containing sodium carbonate and caustic, no carbonic acid is evolved by electrolysis until all the caustic is neutralized.

J. W. RICHARDS.

**Concrete in Mining and Metallurgical Engineering.** BY H. W. EDWARDS. *Mines and Minerals*, August, 1904.—Directions are given for mixtures for concrete for different purposes, also a simple means for testing the strength of concrete beams by using a screw-jack, two I bars and platform scales; and designs are shown of two shapes of flues, suitable for metallurgical plants, made with expanded metal of 1 inch mesh, covered with 2 inches of concrete on each side, also of concrete dust chambers similarly built up, as used at Palomares, Spain, and Sudbury, Canada. The information is valuable for chemical and metallurgical engineers.

J. W. RICHARDS.

**Smelter Smoke and Agriculture.** BY J. A. WIDTSOE. *Eng. Min. J.*, September 29, 1904 (Bull. 88, Utah Agricultural College).—Observations and experiments in the neighborhood of large smelters showed that farms in the path of the prevailing winds suffered most, but with most crops the injury was far from a total loss; farms not in this path are not affected adversely at all. Shade trees were damaged most in early spring; of fruit trees, pears were most affected and plums least; of small fruits, strawberries were affected most; of vegetables, potatoes were most injured; of field crops, corn is most resistant. The air near the smelters contained a maximum of 0.93 per cent. of sulphur dioxide; special dust collectors removed all dust efficiently. Examination of the soils showed no effect of sulphur compounds. The whole question of injury to crops narrows down to the sulphur dioxide, 1 part of it in a million of air, if continuously present, working injury, particularly in a damp climate and on young plants. In the dry air of Utah the effects are relatively small. It has been claimed that the flue-dust deposited on hay poisons the animals eating it, but careful examination of hay most affected by the dust showed remarkably small percentages of copper and arsenic, far below the danger limits usually recognized. Feeding tests with this hay showed that its nutritive value was not impaired. On the other hand, melting snows, accumulating in pools, may carry enough soluble copper and arsenic from such fields to injure animals drinking it.

J. W. RICHARDS.

**Production of Graphite in the United States.** BY J. H. PRATT. *Iron and Mach. World*, September 24, 1904 (from report

of United States Geological Survey).—Natural graphite of the crystalline variety was produced to the amount of 4,538,155 pounds, valued at $154,170; amorphous graphite, 33,182,000 pounds, valued at $71,384, or $4.30 per ton; manufactured graphite, by the Acheson process, 2,620,000 pounds, valued at $235,154. It is thus seen that the manufactured product was of greater total value than all of that mined. J. W. RICHARDS.

**Use of Acheson Graphite in Metallurgical Research.** BY W. McA. JOHNSON. *Electrochem. Ind.*, September, 1904.—This graphite, in blocks, can be machined to within 0.003 inch of any desired shape; the joints can be fitted or threaded. It conducts heat well, so that all parts of an apparatus arrive at nearly the same temperature; this is not true of fire-clay. Below 2500° C. it has an extremely low vapor tension, and neither melts nor sublimes appreciably even at much higher heats. It is naturally a reducing agent, but by lining it with an oxide, such as alumina, it can be used for a wide range of work. It is not damaged by sudden heat changes. It appears to have almost no expansion coëfficient at high temperatures. It makes a very convenient rack for holding Seger cones in a furnace, or a roasting saucer, when brasqued, for roasting at determined temperatures. J. W. RICHARDS.

**Production of Coke in 1903.** BY E. W. PARKER. *Iron Age*, September 15, 1904 (from report of U. S. Geological Survey).—The production was 25,262,360 short tons, valued at $66,459,-623, produced by 77,188 active ovens, of which 1,956 were by-product ovens, producing 1,882,394 tons, or 7.4 per cent. of the whole. At the end of 1903 there were under construction 1,335 new by-product ovens. The average yield of the by-product ovens is 72.25 per cent. of coke, while that of bee-hive ovens is 63.4 per cent. J. W. RICHARDS.

**Segundo Coke Plant.** BY R. M. HOSEA. *Mines and Minerals*, August, 1904.—Description of a new plant of 800 bee-hive ovens, erected with a washing plant near Trinidad, Colorado, to make coke for the Colorado Fuel & Iron Co. Interesting details of the operation of the washery are given. The coal contains 13.02 per cent. of ash, distributed, however, as 5.50 per cent. in the 50 per cent. of slack present, 3.70 per cent. in the 30 per cent. of pea size present, and 3.82 per cent. in the 20 per cent. of nut size present. The three sizes contain respectively 10.99, 12.33 and 19.12 per cent. of their weight of ash. After washing, the three sizes contain respectively 7.26, 8.95 and 13.6 per cent. of ash, making a total of 9.05 per cent. in the washed coal. Of the raw coal, that with density 1.30 contains 6.76 per cent. of ash; 1.35-15.1 per cent.; 1.40-20.09 per cent.; 1.45-23.8 per cent.; all above 1.45-59.1 per cent., showing the opportunity for improvement by washing.

J. W. RICHARDS.

**A Crucible Charge for Gold and Silver in Zinc Ores.** By E. J. Hall and E. Popper. *School of Mines Quarterly*, July, 1904.—After some 200 tests the conclusions were reached that (1) only sufficient litharge should be used to give a lead button of proper size to collect the gold and silver, since any excess going into the slag interferes with the complete decomposition of the ore; (2) soda should be used to four or five times the weight of the ore; (3) borax glass should be added sufficient to prevent the charge from being too basic; (4) argol, if necessary, sufficient to reduce all the lead; (5) a couple of nails, if the ore contains over 15 per cent. of pyrite. The final charge recommended is: Ore, one-third assay ton; soda, one and one-third assay tons; borax glass, one-half; litharge, four-fifths; argol, zero to one-tenth assay ton. Ores containing up to 7.5 per cent. copper and 50 per cent. of zinc can be satisfactorily assayed. J. W. Richards.

**Fire Assaying.** By E. W. Buskett. *Mines and Minerals*, September, 1904.—An elementary presentation of the principles of assaying, containing nothing new. J. W. Richards.

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## ORGANIC CHEMISTRY.

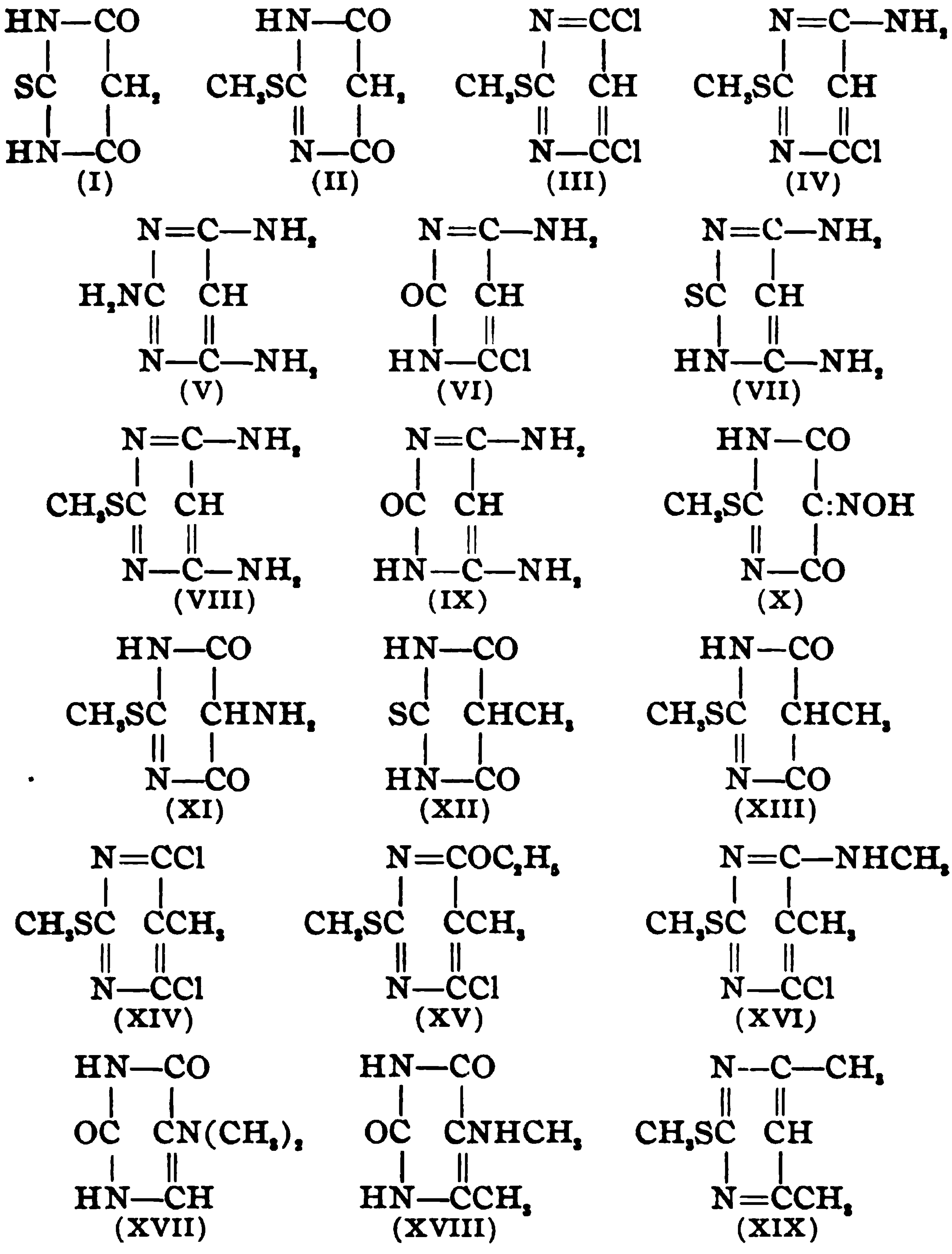
**On Certain Derivatives of the 1,3,5-Triiod-2,4-Dinitrobenzol.** By C. Loring Jackson and J. F. Langmaid. *Am. Chem. J.*, 32, 297-308.—This is one of a series of studies upon the anomalous replacement of halogens by hydrogen in aromatic compounds, and adds three more cases to the rather meager list at present known. Thus, triiododinitrobenzene was changed by hot sodium ethylate into dinitroresorcinol diethyl ether, by sodiomalonic ester into monoiododinitrophenylmalonic ester and diiododinitrobenzene, while with sodium methylate the chief product was triiodonitranisol, together with a smaller amount of a substance apparently $C_6HI(OCH_3)_3(NO_2)$. In some of the experiments an addition-product was isolated, composed of 1 molecule of triiododinitrobenzene and two of diiododinitrobenzene. Experimental. *Preparation of Triiododinitrobenzene.*—Aniline was changed to triiodaniline by the action of iodine chloride, the amino group was then eliminated by the diazo reaction, and the resulting triiodobenzene nitrated. *Action of Sodium Methylate on Triiododinitrobenzene.*—Triiododinitrobenzene was dissolved in absolute methyl alcohol, three molecules of sodium methylate added, and the mixture boiled for eight hours. Among the products formed, triiodonitranisol and a crystalline substance, m. p. 253°-256°, were separated. A single analysis of the latter indicated the formula $C_6HI(NO_2)(OCH_3)_3$, but the amount obtained was too small for identification. *Triiodonitranisol*, $C_6HI_3(NO_2)(OCH_3)$,

crystallizes from alcohol in white or very light-yellow slender prisms, m. p. 128°. *Action of Sodium Ethylate on Triiododinitrobenzene.*—Triiododinitrobenzene, dissolved in absolute alcohol and boiled for fifteen minutes with three molecules of sodium ethylate, yielded dinitroresorcinol diethyl ether, $C_6H_2(NO_2)_2(OC_2H_5)_2$, and a small quantity of another substance crystallizing in plates and melting near 200°, but not obtained in sufficient amount to identify. *Action of Sodiomalonic Ester on Triiododinitrobenzene.*—The main product of the reaction was diiododinitrobenzene, with smaller amounts of iododinitrophenylmalonic ester, and an unidentified substance forming colorless crystals, m. p. about 73°, and containing no iodine. In some of the experiments an addition-compound of the diiodo- and triiododinitrobenezene was obtained. *Diiododinitrobenzene* crystallizes from benzene containing a little alcohol in prisms, from alcohol in long slender needles, of a full yellow color, and melts at 160°. *Iododinitrophenylmalonic Ester,* $C_6H_2I(NO_2)_2CH(COOC_2H_5)_2$, crystallizes from alcohol in yellow rhombic plates, m. p. 83°. *Addition-compound of Diiododinitrobenzene and Triiododinitrobenzene,* $(C_6H_2I_2(NO_2)_2)_2C_6HI_3(NO_2)_2$.—By repeated crystallizaton from a mixture of alcohol and benzene it may be resolved into its two components, from which it may be reproduced by boiling together in alcoholic solution. It crystallizes from alcohol in long, slender, square-ended, pale yellow prisms, m. p. 182°. Benzene breaks it up into its components.

M. T. BOGERT.

**Researches on Pyrimidines: 2-Oxy-4,6-Diaminopyrimidine** (Seventh Paper). BY HENRY L. WHEELER AND GEORGE S. JAMIESON. *Am. Chem. J.*, 32, 342–357.—A number of pyrimidines derived from 2-thiobarbituric acid are described. The chief object of the investigation was to prepare 2-oxy-4,6-diaminopyrimidine in the hope that it might prove identical with the oxydiaminopyrimidine which Kutscher believes he has obtained from yeast nucleic acid. On preparing 2-oxy-4,6-diaminopyrimidine, however, it was found not to be identical with Kutscher's new base. 2-Thiobarbituric acid (Formula I) was converted into 2-methylmercapto-4,6-dioxypyrimidine (Formula II) by sodium ethylate and methyl iodide in alcoholic solution. When this was heated with phosphorus pentachloride (or better, oxychloride) the dichloride (Formula III) was obtained, which changed to 2-methylmercapto-5-chlorcytosine (Formula IV) when heated with alcoholic ammonia at 125°-190°; above 190° triaminopyrimidine (Formula V) was formed. The mercaptochlorcytosine (Formula IV), when boiled with hydrochloric acid, yielded 4-chlorcytosine (Formula VI). By the action of alcoholic ammonia upon the latter the oxydiaminopyrimidine was not obtained. It was obtained, however,

from 2-thio-4,6-diaminopyrimidine (Formula VII). The latter was treated with methyl iodide and the addition-product decomposed by ammonia. The resulting mercapto derivative (Formula VIII), carefully boiled with hydrochloric acid, gave the required 2-oxy-4,6-diaminopyrimidine (Formula IX).




EXPERIMENTAL.—*2-Thiobarbituric Acid* (Formula I) was prepared by Michael's method from sodium ethyl malonate and thiourea. From 25 grams ethyl malonate 16.5 grams thiobarbituric

acid were obtained. *2-Methylmercaptobarbituric Acid* (Formula II), from thiobarbituric acid, sodium ethylate and methyl iodide (yield 53 to 66 per cent. of theory), crystallizes from water in needles and does not melt at 300°. Heated with phosphorus pentachloride (or better, oxychloride) it is changed to *2-methylmerecapto-4,6-dichlorpyrimidine* (Formula III); stout pointed prisms, m. p. 41°-42°, b. p. 135°-136° at 14 mm., 154° at 28 mm. *2-Methylmercapto-4-chlor-6-aminopyrimidine* (Formula IV), from the above dichloride and alcoholic ammonia at 125°-126°, crystallizes from water in colorless needle-like prisms, m. p. 127°-128°. When this chloraminopyrimidine was heated with alcoholic ammonia at 185°-220° it was changed to *2,4,6-triaminopyrimidine* (Formula V). *4-Chlorcytosine* (Formula VI) was obtained from the above mercapto derivative by boiling it with concentrated hydrochloric acid. The free base forms flat, colorless prisms, fairly soluble in water, and not melting at 300°. The hydrochloride crystallizes from water in balls of very small, slender, hard prisms or needles. The chlorine in chlorcytosine could not be removed by tin and hydrochloric acid or by hydriodic acid and red phosphorus. Heated at 183° with alcoholic ammonia it did not give the oxydiaminopyrimidine, but an unidentified crystalline *substance,* not melting at 307°, and free from chlorine. *2-Methylmercapto-4,6-diaminopyrimidine* (Formula VIII). *2-Thio-4,6-diaminopyrimidine* (Formula VII), prepared by Traube's method from malonic nitrile and thiourea, was treated with methyl iodide and the resulting addition-product decomposed by ammonia. The methylmercapto derivative thus obtained crystallizes from water in slender prisms, m. p. 185°-186°, with slight effervescence. *2-Oxy-4,6-diaminopyrimidine* (Formula IX) was obtained by boiling the above mercapto body with concentrated hydrochloric acid. It crystallizes from water in slender rectangular anhydrous prisms, turning yellow at about 297°, but not melting at 347°. The monohydrochloride crystallizes from water in long slender prisms, not melting at 307°. The picrate crystallizes from water in thin tables or slender prisms of bright yellow color, which sinter at about 185° and melt with effervescence at 210°-214°. Too long heating of the base with hydrochloric acid changes it to barbituric acid. *2-Methylmercaptovioluric Acid* (Formula X), from 2-methylmercapto-4,6-dioxypyrimidine and nitrous acid, forms a brick-red precipitate, decomposing at 180°-200°. The ammonium and sodium salts have a purple color. The acid also crystallizes in red, flat, pointed prisms, containing two molecules of water. *2-Methylmercaptouramil* (Formula XI) was prepared from the above by reduction with ammonium sulphide. It is difficultly soluble in hydrochloric acid, but dissolves in caustic soda. At 285° it turns brown, but does not melt at 301°. *2-Thio-5-methylbarbituric Acid* (Formula XII)

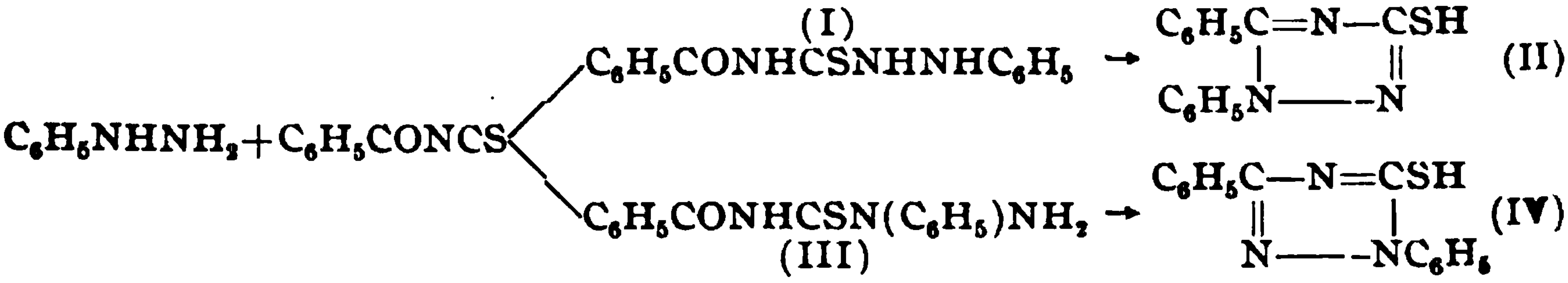
(with H. F. Merriam), from methylmalonic ethyl ester thiourea and sodium ethylate, crystallizes from water in thin plates, containing one molecule of water, and melting, with effervescence, at 244°. *2-Thio-5-ethylbarbituric Acid* crystallizes from water in long needle-like prisms, containing water of crystallization, and melting at 190°-191°. *2-Methylmercapto-4,6-dioxy-5-methylpyrimidine* (Formula XIII), from 2-thio-5-methylbarbituric acid boiled with alcohol and excess of methyl iodide, crystallizes from strong acetic acid in short prisms, decomposing with effervescence melting at 190°-191°. *2-Methylmercapto-4,6-dioxy-5-methylpyr-* melts with effervescence at about 257°. *2-Methylmercapto-4,6-dichlor-5-methylpyrimidine* (Formula XIV) was prepared from the above 2-methylmercapto-4,6-dioxy-5-methylpyrimidine and phosphorus pentachloride. It crystallizes in stout colorless prisms, m. p. 64°, b. p. 153°-154° at 18 mm. Heated with sodium ethylate, it forms *2-methylmercapto-4-chlor-5-methyl-6-ethoxypyrimidine* (Formula XV) crystallizing from alcohol in beautiful colorless prisms, m. p. 85°. If the dichlor compound be heated at 145° with alcoholic methylamine the product is *2-methylmercapto-4-chlor-5-methyl-6-methylaminopyrimidine* (Formula XVI), crystallizing from alcohol in stout prisms, m. p. 157°. *5-Dimethylaminouracil* (Formula XVII) was prepared by heating 5-bromuracil with excess of dimethylamine at 150°. It crystallizes from water in small, thin, colorless plates or films, melting with strong effervescence at about 297°. *4-Methyl-5-methylaminouracil* (Formula XVIII), from 4-methyl-5-bromuracil and methylamine at 150°, crystallizes from water containing a little alcohol in beautiful colorless prisms, m. p. 214°. Crystallized from water it carries one molecule of water of crystallization. The presence of much alcohol in the water causes it to separate anhydrous. The monohydrochloride forms beautiful transparent stout prisms, which melt with strong effervescence at 273°, and are less soluble in water than the free base. *2-Methylmercapto-4,6-dimethylpyrimidine* (Formula XIX) (with G. S. Jamieson) was prepared by condensing the methyl iodide addition-product of thiourea with acetylacetone in presence of alkali. It congeals to a white ice-like mass, m. p. 23°-24°, b. p. 123°-125° at 14 mm., 135°-137° at 28-29 mm., 144° at 33 mm. A *substance* was obtained as a by-product in this preparation, which crystallizes from alcohol in colorless rectangular prisms, m. p. 153°-154°, and whose nitrogen determination agreed with that calculated for a dicyandiamide addition-product of 2-methylmercapto-4,6-dimethylpyrimidine. *2-Oxy-4,6-dimethylpyrimidine,* prepared by boiling 2-methylmercapto-4,6-dimethylpyrimidine with hydrobromic acid and then neutralizing with alkali, was crystallized from water, and then melted at 198°-199° (Evans gives the m. p. as 190°-195°).

M. T. BOGERT.

**On the Action of Phenylhydrazine on Benzoylpseudoureas: 1,5-Diphenyl-3-Aminopyrro-$\alpha,\beta'$-Diazole Derivatives.** BY TREAT B. JOHNSON AND GEORGE A. MENGE. *Am. Chem. J.*, 32, 358–372.—Acylthiocarbamates, RCONHCSOR, RCONHCOSR, acyldithiocarbamates, RCONHCSSR, acylimidothiocarbonates, RCON : C(OR)(SR), and acylimidodithiocarbonates, RCON : $C(SR)_2$, react with phenylhydrazine to form 1,5-dialkyltriazoles. The results obtained indicated that the relative tendency of the groups to react with the amino hydrogen of the phenylhydrazine was CSR>CS>CO>COR. The present investigation was undertaken to discover whether this would hold true in other types of compounds containing the same groups, or whether there was a general tendency for 1,5-dialkyltriazoles to form in preference to 1,3-dialkyltriazoles. The acyloxygenpseudoureas, RCON : $C(OR)NH_2$, should yield 1,3-dialkyltriazoles, since water is represented as separating in preference to alcohol. They were found to yield 1,5-dialkyltriazoles, however. 1,3-Diphenyl-5-mercaptotriazole can be prepared easily by combining benzoyl rhodanide with acetonephenylhydrazone, and boiling the resulting semicarbazide with dilute hydrochloric acid or with water. Phenylhydrazine reacts with benzoyl rhodanide to form four definite products: Two isomeric benzoylphenylthiosemicarbazides, 1,5-diphenyl-3-mercaptotriazole, and 1,3-diphenyl-5-mercaptotriazole. Pseudoethylthiourea combines with benzoylimidodiethylthiocarbonate at ordinary temperature to form ethylmercaptoethoxyphenyl-1,3,5-triazine, while, with the same thiocarbonate, hydroxylamine reacts to form $\alpha'$-phenyl-$\beta$-ethoxyfuro-$\alpha,\beta'$-diazole. Acyloxygenpseudoureas also react easily with hydroxylamine, giving furo-$\alpha$-$\beta'$-diazoles. Benzoyl rhodanide reacts readily with chlorine gas, the resultant benzoylisocyanchloride being intensely reactive. EXPERIMENTAL.—The acyloxygenpseudoureas described were prepared by allowing amines to act on acylimidothiocarbonates at ordinary temperature. When pure they are beautifully crystalline and comparatively stable. *Benzoylimidodimethylthiocarbonate,* $C_6H_5CON:C(OCH_3)(SCH_3)$, from methylbenzoylthioncarbamate, sodium ethylate and methyl iodide crystallizes from ligroin in colorless prisms, m. p. 45°, b. p. 200° at 20 mm. *Benzoylpseudomethyl-m-nitrophenylurea,* $C_6H_5CON:C(OCH_3)NHC_6H_4NO_2$, previously obtained as an intermediate product in the preparation of benzoylnitrophenylurea from *m*-nitraniline and benzoylimidomethylthiolethylcarbonate, crystallizes from alcohol in needle-like prisms, m. p. 86°-88°. *Benzoylpseudomethylpseudocumylurea.* from pseudocumidine and benzoylimidomethylthiolethylcarbonate, crystallizes from alcohol in beautiful needle-like prisms, m. p. 87°-89°. *1,5-Diphenyl-3-pseudocumylaminotriazole,*

$$\begin{array}{l} C_6H_5C{=}N{-}C{-}NHC_6H_2(CH_3)_3 \\ \qquad\;\; | \qquad\;\; \| \\ C_6H_5N{-\!-\!-\!-}N \end{array},$$

obtained by heating the above pseudocumylurea with phenylhydrazine, crystallizes from alcohol in needle-like prisms, m. p. 121°-123°. *1,5-Diphenyl-3-phenylaminotriazole,* obtained by heating benzoylpseudoethylphenylurea with phenylhydrazine, crystallizes from alcohol in needles, m. p. 202°. *Benzoylpseudoethyl-m-nitrophenylurea,* from *m*-nitraniline and benzoylimidodiethylthiocarbonate, crystallizes from alcohol in prisms, m. p. 86°-88°. *Benzoylpseudoethyl-m-chlorphenylurea,* from *m*-chloraniline in similar manner, crystallizes from alcohol in prisms, m. p. 47°-48°. Heated with phenylhydrazine, it yields *1,5-diphenyl-3-m-chlorphenylaminotriazole;* prisms (from alcohol), m. p. 195°-196°. *Benzoylpseudoethylparatolylurea;* needles (from alcohol), m. p. 77°-78°. Heated with phenylhydrazine, it yields *1,5-diphenyl-3-paratolylaminotriazole;* minute prismatic crystals (from alcohol), m. p. 227°-228°. *Benzoylpseudoethylparaanisylurea* crystallizes from alcohol in long, slender prisms, m. p. 66°-67°. Heated with phenylhydrazine, it gives *1,5-diphenyl-3-paraanisylaminotriazole;* slender prisms (from alcohol), m. p. 224°-225°. *Benzoylpseudoethylpseudocumylurea* crystallizes from alcohol in prisms, m. p. 79°-80°. *The Action of Benzoyl Rhodanide on Phenylhydrazine.*—This apparently takes place according to the following scheme:



Of these four products, all but the substance corresponding to Formula III were isolated and identified. *Acetone Derivative of a-Benzoyl-b-phenylthiosemicarbazide,* $C_6H_5CONHCSN(C_6H_5)N:C(CH_3)_2$, from benzoyl rhodanide and acetonephenylhydrazone, crystallizes from alcohol in prisms, m. p. 136°. Treatment with hydrochloric acid, or long boiling with water, converts it into 1,3-diphenyl-5-mercaptotriazole. The *Condensation of Pseudoethylthiourea with Benzoylimidodiethylthiocarbonate* takes place according to the following equation:

$$C_6H_5CON:C(OC_2H_5)SC_2H_5 + HN:C(SC_2H_5)NH_2 =$$
$$N:C(OC_2H_5)N:C(SC_2H_5)N:CC_6H_5.$$

The *ethylmercaptoethoxyphenyl-1,3,5-triazine* thus produced crystallizes from ligroin in prisms, m. p. 47°-48°. *a'-Phenyl-β-ethoxyfuro-a,β'-diazole,* $O.C(C_6H_5):N.C(OC_2H_5):N$, was prepared from benzoylimidodiethylthiocarbonate and hydroxylamine, according to the following scheme:

$$C_6H_5CON:C(OC_2H_5)SC_2H_5 + NH_2OH \rightarrow$$
$$C_6H_5CON:C(OC_2H_5)NHOH \rightarrow C_6H_5C:N.C(OC_2H_5):N.O.$$

It crystallizes from alcohol in stout prisms, m. p. 47°-48°. *α'-Ethoxy-β-phenylfuro-α,β'-diazole* was prepared from the silver salt of α'-oxy-β-phenyl-furo-α,β'-diazole and ethyl iodide. It is identical with the substance previously described by Falck, and the alkyl group is, therefore, united to oxygen, and not to nitrogen as assumed by Falck. *Benzoylisocyanchloride*, $C_6H_5CONCCl_2$, from benzoyl rhodanide and chlorine in chloroform solution, is an oil which has a very penetrating odor and attacks the eyes. It boils at 146°-148° at 31 mm., is very sensitive to moisture, and reacts violently with alcohols and amines. M. T. BOGERT.

**The Action of Potassic Nitrite on Mucobromic Ester.** BY H. B. HILL AND O. F. BLACK. *Am. Chem. J.*, **32**, 228–242.—In 1882, Hill and Sanger, by the action of potassium nitrite upon ethyl mucobromate, obtained a compound of the formula $C_6H_6O_6NK$, the structure of which was not discovered. It is now shown to be potassium ethyl nitromaleate, $KOOCCH:C(NO_2)COOC_2H_5$. By the action of baryta water, it is changed to a basic barium nitromalate, the free nitromalic acid decomposing with formation of nitrolactic acid when set free from this basic salt by the action of mineral acid. Various salts and derivatives of these acids are also described. EXPERIMENTAL.—Mucobromic acid was prepared by oxidizing furol with water and excess of bromine, and was then esterified by alcohol and hydrochloric or sulphuric acids. *Potassium Ethylnitromaleate* separates in light green crystals, when a dilute alcoholic solution of ethyl mucobromate and potassium nitrite is allowed to stand two or three days. The pure substance crystallizes in colorless flat prisms, sparingly soluble in cold water, more readily in hot. It is very stable, not being decomposed by evaporation with strong hydrochloric acid. *Ammonium* and *aniline salts* were also prepared. *Potassium Methylnitromaleate*, prepared in a similar manner from methyl mucobromate and potassium nitrite, closely resembles the ethyl compound in its properties. *Action of Bromine and Water on Potassium Ethylnitromaleate.*—This caused the breaking-up of the nitromaleate into glyoxylic acid and dibromnitromethane. The same products were obtained from methylnitromaleate. *The Action of Ammonia on Potassium Ethylnitromaleate* resulted in the formation of *nitromaleic amide*, $HOOCCH:C(NO_2)CONH_2$. *Silver Salt,* minute white crystals. *Potassium Salt,* white crystals, very sparingly soluble in water. *Ammonium Salt,* fine white needles, more soluble than the potassium salt. *Aniline Salt. The Action of Baryta Water on Potassium Ethylnitromaleate* gives an insoluble basic barium nitromalate, $Ba(C_4H_2O_7N)_2$. On the addition of hydrochloric acid β-nitrolactic acid is formed with evolution of carbon dioxide. *β-Nitrolactic Acid*, $CH_2(NO_2)CHOHCOOH$, thus obtained, crystallizes from ether and chloroform in small irregular

white prisms, m. p. 76°-77° (uncorr.). It is very soluble in water, alcohol or ether. By crystallization of the strychnine salt an optically active form was separated, 0.3494 gram of which showed a laevo rotation of 0.69°, corresponding to a specific rotation of about 20°. *Silver Nitrolactate* crystallizes from warm water in fine white needles. The *barium* and *calcium salts* are also described. *Acetnitrolactic Acid,* prepared by the action of acetic anhydride upon the nitrolactic acid, crystallizes from a mixture of ether and chloroform in large perfect white octahedra, freely soluble in water. *Silver Salt,* gleaming white needles, decomposed by heating with water (while the nitrolactate is not thus decomposed). *Reduction of Nitrolactic Acid* with tin and hydrochloric acid yielded β-amino-α-lactic acid, or isoserine, which was further identified by a determination of its solubility and by the preparation of its characteristic copper salts. M. T. BOGERT.

**The Decomposition of Nitroso Compounds.** BY WILLIAM A. NOYES AND RENÉ DE M. TAVEAU. *Am. Chem. J.*, 32, 285–293. —The purpose of the present paper was to determine whether the decomposition of the nitroso derivative of the anhydride of aminolauronic acid gives only the lactone, as implied by Bredt, or whether other compounds are also formed. In the course of the work a new class of compounds was discovered. EXPERIMENTAL. *Preparation of Camphoramidic Acids.*—The working details are given in full for the preparation of the α- and β-camphoramidic acids from camphoric anhydride. α-Camphoramidic acid was changed to the hydrochloride of aminolauronic acid, from which the corresponding anhydride was prepared by distilling with lime. The anhydride may also be obtained by heating the free amino acid to 300° in an oil-bath. Its boiling-point is 285°, while that of the isomer derived from dihydroaminocampholytic acid is 285°-287°. The rotation of a 7 per cent. solution in alcohol is $[\alpha]_D = -60.1$ at 26°. The nitroso derivative melts at 138°-139°. Moistened with strong alcohol and treated with 10 per cent. caustic soda solution it is decomposed with formation of a *hydrocarbon,* $C_8H_{14}$; a *condensation product,* $(\overline{COC_8H_{14}N}C_2H_4O)_2$; *isolauronolic acid,* $C_8H_{14}COOH$; a *hydroxy acid,* $HOC_8H_{11}COOH$; and isocampholactone, $\overline{OC_8H_{14}CO}$. The yields of these various products from 19.5 grams of the nitroso dervative were, respectively, 2.5 grams, 5 grams, 1.2 grams, 1.5 grams, and 1.3 grams. The hydroxy acid boils at 180°-185° at 25 mm. pressure, and is evidently the same acid as that whose ester is formed by the action of nitrous acid on ethyl aminolauronate. *Isocampholactone* is laevorotatory. For a 5 per cent. solution in alcohol $[\alpha]_D = -60.7$. The *silver salt* of the hydroxy acid corresponding to the lactone, $HOC_8H_{14}$

COOAg, was prepared. The *condensation product* crystallizes from ligroin in large, well-formed plates of a faint yellow color, m. p. 104°, insoluble in water, slightly soluble in dilute hydrochloric acid and reprecipitating unchanged on addition of ammonia. When methyl alcohol is used instead of ethyl in the decomposition of the nitroso compound the condensation product obtained is $(\overline{COC_8H_{14}N}CH_2O)_2$, crystallizing from ligroin in leaflets, m. p. 99°. With isoamyl and allyl alcohols the condensation products obtained could not be crystallized. These condensation products form a new class of substances, and the reaction by which they are formed appears to be a new kind of decomposition of nitroso bodies. The filtrate from the methyl alcohol condensation product contained a bibasic acid, $(C_9H_{15}NO_2)_2$, m. p. 327°-328°, which may be an azo compound of the structure $HOOCC_8H_{14}N:NC_8H_{14}COOH$. M. T. BOGERT.

**On the Composition of Petroleum.** BY CHARLES F. MABERY. *Proc. Am. Acad. Arts and Sci.*, 40, 323-362.—I. *The Hydrocarbons in Ohio Trenton Limestone Petroleum with Boiling-points above 213°* (with O. R. Palm). The crude oil was obtained from Welker, Ohio; sp. gr. at 20°, 0.8367; carbon, 85.46 per cent.; hydrogen, 13.91 per cent.; sulphur, 0.48 per cent. It was first fractioned below 200° at ordinary pressure, and then at 30 mm pressure. The higher boiling fractions were rectified at 30 mm. pressure, were freed from solid paraffins by cooling and filtering, purified with concentrated, then with fuming, sulphuric acid, washed with caustic soda solution, and dried with calcium chloride and finally with sodium. The fractions thus purified were found to represent definite hydrocarbons, which were identified by analysis, molecular weight determinations, and by their indexes of refraction. The following hydrocarbons were identified: $C_{12}H_{24}$, b. p. 211°-213°, sp. gr. at 20°, 0.7970; $C_{13}H_{26}$, b. p. 223°-225°, 123°-125° at 30 mm., sp. gr. at 20°, 0.8055; $C_{14}H_{25}$, b. p. 138°-140° at 30 mm., sp. gr. at 20°, 0.8129; $C_{15}H_{30}$, b. p. 152°-154° at 30 mm., sp. gr. at 20°, 0.8204; $C_{16}H_{32}$, b. p. 164°-168° at 30 mm., sp. gr. at 20°, 0.8249; $C_{17}H_{34}$, b. p. 177°-179° at 30 mm., sp. gr. at 20°, 0.8335; $C_{19}H_{36}$, b. p. 198°-202° at 30 mm., sp. gr. at 20°, 0.8364; $C_{21}H_{40}$, b. p. 213°-217° at 30 mm., sp. gr. at 20°, 0.8417; $C_{22}H_{42}$, b. p. 224°-227° at 30 mm., sp. gr. at 20°, 0.8614; $C_{24}H_{46}$, b. p. 237°-240° at 30 mm., sp. gr. at 20°, 0.8639; $C_{23}H_{42}$, b. p. 253°-255° at 30 mm., sp. gr. at 20°, 0.8842; $C_{24}H_{44}$, b. p. 263°-265° at 30 mm., sp. gr. at 20°, 0.8864; $C_{25}H_{46}$, b. p. 275°-278° at 30 mm., sp. gr. at 20°, 0.8912. Ohio petroleum is, therefore, composed chiefly of the series $C_nH_{2n+2}$, $C_nH_{2n}$, $C_nH_{2n-2}$ and $C_nH_{2n-4}$. It is probable that series still poorer in hydrogen exist in the portions which cannot be distilled un-

decomposed. It resembles Pennsylvania petroleum in the large proportion of solid paraffins, but the greater portion of the fractions above 216° consist of the $C_nH_{2n}$ series, which, together with the presence of series still poorer in hydrogen, explains the higher specific gravity of the crude oil and of its distillates. II. *The Hydrocarbons in Canadian Petroleum with High Boiling-points.*—The following hydrocarbons were identified: $C_{12}H_{24}$, b. p. 216°; $C_{13}H_{26}$, b. p. 228°-230°, sp. gr. at 20°, 0.7979; $C_{14}H_{28}$, b. p. 141°-143° at 50 mm., sp. gr. at 20°, 0.8099; $C_{15}H_{30}$, b. p. 159°-160° at 60 mm., sp. gr. at 20°, 0.8192. From these hydrocarbons chlorine derivatives were prepared as follows: $C_{12}H_{23}Cl$, b. p. 160° at 15 mm., sp. gr. at 20, 0.9145; $C_{13}H_{25}Cl$, b. p. 165 at 15 mm., sp. gr. at 20°, 0.9221; $C_{14}H_{27}Cl$, b. p. 180 at 15 mm., sp. gr. at 20°, 0.9288; $C_{15}H_{29}Cl$, b. p. 190° at 15 mm., sp. gr. at 20°, 0.9358. The higher specific gravity of Canadian crude oil, as compared with Ohio, Pennsylvania and other crude oils, is due to the greater amount present of series of hydrocarbons low in hydrogen. The series $C_nH_{2n}$ does not appear in Pennsylvania oil until $C_{17}$ is reached; in Ohio oil it begins at $C_{12}$, and in Canadian oil at $C_{11}$. III. *Hydrocarbons in Santa Barbara Crude Oil.*—The crude oil came from wells sunk below the Pacific Ocean, and was very heavy (sp. gr. at 20°, 0.9845) and of tarry consistency. It contained 86.32 per cent. of carbon, 11.70 per cent. hydrogen, 1.25 per cent. nitrogen, and 0.84 per cent. sulphur. The following hydrocarbons were separated: $C_{13}H_{24}$, b. p. 150°-160° at 60 mm., sp. gr. at 20°, 0.8621; $C_{16}H_{30}$, b. p. 175°-180° at 60 mm., sp. gr. at 20°, 0.8808; $C_{17}H_{30}$, b. p. 190°-195° at 60 mm., sp. gr. at 20°, 0.8919; $C_{18}H_{32}$, b. p. 210°-215° at 60 mm., sp. gr. at 20°, 0.8996; $C_{24}H_{44}$, b. p. 250°-255° at 60 mm., sp. gr. at 20°, 0.9299; $C_{27}H_{46}$, b. p. 310°-315° at 60 mm., sp. gr. at 20°, 0.9451; $C_{29}H_{50}$, b. p. 340°-345° at 60 mm., sp. gr. at 20°, 0.9778. The most volatile distillates are composed of the series $C_nH_{2n-2}$, in the higher boiling fractions the proportion of hydrogen rapidly sinking to the $C_nH_{2n-8}$ series. These higher boiling viscous hydrocarbons evidently approach the constituents of the asphaltic oils and natural tars in their character. "It is easy to see how petroleum is converted by slow evaporation in nature into the great beds of tars and asphalts, and it affords the most plausible explanation of their formation." IV. *Separation of Solid Paraffin Hydrocarbons from Petroleum without Evaporation* (with Otto J. Sieplein).—A sample of Pennsylvania crude petroleum was exposed in a shallow pan to a strong current of air for thirty days, the result being a loss of two-thirds its original weight. The amount of solid hydrocarbons in the residue was determined by treating with fusel oil at 0° for twenty-four hours, precipitating the solution with alcohol, and purifying the precipitate. The crude product amounted to 39.6 per

cent. of the residue, or to 14 per cent. of the original oil. The purified substance was identical with paraffin. Paraffin, therefore, exists as such in Pennsylvania petroleum, and is not formed during the distillation. V. *The Solid Paraffin Hydrocarbons that Collect in Certain Oil Wells in Pennsylvania.*—In certain of the Pennsylvania wells a semi-solid pasty substance collects in considerable quantity, and is apparently an emulsion of solid hydrocarbons in high-boiling oils. The specimen investigated showed a specific gravity at 60° of 0.8345. It was fractioned, and the higher fractions dissolved in a mixture of ether and alcohol, well cooled, and the separated solid removed and purified. The following hydrocarbons were identified: $C_{24}H_{50}$, m. p. 50°-51°, sp. gr. at 60°, 0.7900; $C_{31}H_{64}$, m. p. 66°, sp. gr. at 70°, 0.7997; $C_{32}H_{66}$, m. p. 68°-70°, sp. gr. at 75°, 0.8005; $C_{34}H_{66}$, m. p. 71°-72°, sp. gr. at 80°, 0.8009; $C_{35}H_{72}$, m. p. 76°, sp. gr. at 80°, 0.8052. VI. *Composition of Commercial Paraffin.*—The following hydrocarbons were identified: $C_{23}H_{48}$, m. p. 48°, b. p. 256°-258° at 40 mm., sp. gr. at 60°, 0.7836; $C_{24}H_{50}$, m. p. 50°-51°, b. p. 272°-274° at 40 mm.; $C_{25}H_{52}$, m. p. 54°, b. p. 282°-284° at 40 mm., sp. gr. at 60°, 0.7911; $C_{26}H_{54}$, m. p. 55°-56°, b. p. 294°-296° at 40 mm., sp. gr. at 60°, 0.7938; $C_{28}H_{58}$, m. p. 60°, b. p. 316°-318° at 40 mm.; $C_{29}H_{60}$, m. p. 62°-63°, b. p. 346°-348° at 40 mm. VII. *Composition of Commercial Vaseline, Cosmoline, and Similar Products.*—Fractional distillation showed vaseline to be composed of heavy oils of the $C_nH_{2n}$, $C_nH_{2n-2}$ and $C_nH_{2n-4}$ series together with solid paraffin hydrocarbons. The amount of these solid hydrocarbons is more than sufficient to saturate the oil, so that an emulsion results of the desired consistency.

M. T. BOGERT.

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## BIOLOGICAL CHEMISTRY.

**A Contribution to the Study of Pathogenic Yeasts.** BY LEO F. RETTGER. *Centrbl. f. Bacteriol, Parasitenkunde, u. Infections krankheiten*, 36, 519–528.—The yeast was obtained from a pustule on the neck caused by a slight razor cut. Various cultures when introduced into the organism of the rabbit, guinea-pig, pigeon and mouse lead to pathological conditions or even death. It appears to be destroyed in the larger blood vessels, but is able to persist in some of the tissues. Morphologically, it closely resembles ordinary bread yeast, but in its choice of nutrient media and in its modes of growth it is different. Contrary to common yeast, it grows best at incubator temperature and in the usual culture media. It develops very slowly in sugar solutions, and produces no alcoholic fermentation. F. P. UNDERHILL.

**A Clinical Study of the Haemolytic Action of Human Blood Serum.** BY JOHN METCALF POLK. *J. Med. Research*, 12 (New Series 7), 263-294.—Polk finds by studying the factors involved in the production of haemolysis of rabbits erythrocytes by human blood serum that it is unlikely that the haemolytic action of human blood serum in disease is always identical with the specific type of that action discussed by Ehrlich. Some of the factors which tend to modify haemolysis and which are not always sufficiently considered are the temperature at which the whole blood or the serum alone is kept; the order in which serum, red cells, and salt solution are added in the mixture, the condition of the experimental rabbits, etc. The factors have been carefully considered here and all the experiments were accordingly carried out under identical conditions with the result that the above conclusions seemed warranted. The haemolytic action of blood serum in various diseases upon rabbit blood has also received attention with the result that it was found there is a low haemolytic action of the serum in anaemia, an increase of this property in most infectious diseases, and a striking increase in diabetes. F. P. UNDERHILL.

**Experiments with Tuberculins made from Human and Bovine Tubercle Bacilli.** BY S. B. WOLBACH AND HAROLD C. ERNST. *J. Med. Research*, 12 (New Series 7), 295-312.—The purpose of the investigation was to repeat the work of Koch as to the therapeutic action of tuberculin upon tuberculous guinea-pigs, and to test for differences in specificity in tuberculins made from human and bovine tubercle bacilli. The results of the work warrant the conclusions that there is no difference in specificity between the tuberculins from the two sources; that the tuberculin treatment (according to the method of Koch) acts favorably upon tuberculous guinea-pigs, and that there are no essential differences in the disease processes caused by the two kinds of tubercle bacilli.

F. P. UNDERHILL.

**The Further Differentiation of Flagellar and Somatic Agglutinins.** BY HENRY G. BEYER AND ARTHUR L. REAGH. *J. Med. Research*, 12 (New Series 7), 313-329.—The flagellar and somatic agglutinins and agglutinable substances of the hog-cholera bacillus may be differentiated by heat. A temperature of 70° C., acting for at least twenty minutes, impairs the somatic agglutinin of the serum and the flagellar agglutinable substance of the hog-cholera bacillus. It leaves nearly intact the flagellar agglutinin of the serum and the somatic agglutinable substance of the bacilli. The impairment is manifested by the absence of clumping, and is referable to a destruction of the agglutinophore group of these bodies. A higher temperature is required to differentiate the flagellar and somatic bodies of the hog-cholera than is necessary (Joos) in separating the corresponding substances of the typhoid

bacillus. The temperature of 70° C., which is sufficient to destroy the agglutinating power of motile hog-cholera bacilli, does not affect their power of generating the flagellar agglutinin in the animal body. F. P. UNDERHILL.

**The Experimental Production of Liver Necrosis by the Intravenous Injection of Hemagglutinins.** BY RICHARD M. PEARCE. *J. Med. Research,* 12 (New Series 7), 329–340.—Hemagglutinative sera were prepared by injecting the rabbit with various organs and fluids of the dog. These include sera prepared by injecting defibrinated blood, washed blood corpuscles, blood serum, bile, urine, washed and unwashed liver, pancreas, kidney, and adrenal. The sera were injected into the saphenous vein of the dog, and after varying periods of time the animals were killed by chloroform and the tissues examined histologically. Liver necroses were readily produced by sera obtained by injecting bile, blood, and blood-containing organs; they did not occur after the use of sera prepared by injecting urine, serum, and washed organs. F. P. UNDERHILL.

**On the Precipitin Reaction of Human and Cow's Lacto and Caseo Sera.** BY SAMUEL AMBERG. *J. Med. Research,* 12 (New Series 7) 341-359.—The human casein was prepared by the method of Kobrak (Pflüger's *Arch.,* 80, 69 (1900)) and the sera were obtained by injecting rabbits with human milk and casein, and cow's casein. With regard to the part played by calcium in the precipitin reaction of lacto and caseo serum it was found that the reaction does not depend upon the casein being in the form of a calcium salt, since the reaction takes place equally well with sodium caseinate solutions. The presence of a soluble inorganic calcium salt is not necessary to the reaction. The influence which the addition of calcium chloride exercises on the precipitin reaction is not clear, but it cannot be due to the formation of calcium caseinate. The addition of calcium chloride to the casein solutions accelerates the reaction markedly. Casein, as present in milk, differs from Hammarsten's casein, whether used as sodium or calcium salt. There is no difference between lacto and caseo serum in their behavior toward their corresponding milk, casein and lactalbumin. An interaction of cow's lacto and caseo serum with human milk, casein or lactalbumin, and *vice versa,* does not occur. There is a stage in the precipitin reaction where the addition of either precipitin or precipitable substance to the clear supernatant fluid causes a further precipitate.

F. P. UNDERHILL.

**The Pathological Effects of Periodic Losses of Blood—An Experimental Study.** BY THEOBALD SMITH. *J. Med. Research,* 12 (New Series 7), 385–407.—The regular periodic abstrac-

tion of blood from horses, used in the production of antitoxins, after it has been carried on for two or three years, leads, in certain cases, to serious derangements and death. Smith has endeavored to account for this by a study of the blood of normal horses and that of these animals used for the production of the antitoxins. It was found that the maximum and minimum resistance of the red corpuscles of the normal horse are approximately 0.42 and 0.60 per cent. salt solution. The resistance of the red corpuscles of most of the horses which had been repeatedly bled was so changed as to correspond to a rise in osmotic tension of 0.04 to 0.09 per cent. salt solution, in the latter case to nearly one-half the total range of resistance (0.42 to 0.60 per cent.). There is no evidence to show that the injection of diphtheria toxin plays any appreciable part in this change. The osmotic tension of the serum does not adapt itself to the change in the corpuscles.

F. P. UNDERHILL.

**The Influence of Various Fats on the Formation and Excretion of Acetone.** BY ELLIOTT P. JOSLIN. *J. Med. Research*, 12 (New Series 7), 433-450.—These experiments were carried out upon man during periods of hunger lasting two days, and the fats fed were sodium palmitate, tristearin, triolein; the influence of stearic, oleic, palmitic and butyric acid, and of glycerol and sodium bicarbonate was observed. The acetone was determined in the urine and in the breath. That of the urine was determined by the Messinger-Hüppert method and that of the breath by the method of Müller, modified. Ammonia and nitrogen were also determined in the urine, and the feces were examined for fat in order to get proof of their absorption. Control experiments showed that acetone increases in the first few days of starvation. Variations of 100 milligrams are within normal limits. With palmitic and stearic acid the most striking feature observed was the lack of absorption—practically 80 per cent. being recovered from the feces. The influence on the excretion of acetone was *nil*, or else tended to diminish the excretion. With triolein and tristearin 50 per cent. of the former and 75 per cent. of the latter was recovered from the feces. They both retarded the excretion of acetone. Glycerol (10.8 grams) retarded the excretion of acetone to a greater degree than any other of the substances used. Sodium bicarbonate (31.4 grams) had practically no influence on the elimination of acetone. Oleic acid produced a marked acetonuria, amounting to 34 per cent., and 97 per cent, above the control experiments in the healthy starving subject, while the same quantity of butyric acid was without effect. Sodium palmitate produced a marked acetonuria.

F. P. UNDERHILL.

**The Autolysis of Animal Organs. II. Hydrolysis of Fresh and Self-Digested Glands.** BY P. A. LEVENE. *Am. J.*

*Physiol.*, 12, 276–297.—The present communication represents the results of the analysis of the basic constituents of the pancreas, spleen and liver after hydrolysis of the fresh glands with acid (sulphuric, 5 per cent.) and also hydrolysis subsequently to an autolysis of ten weeks duration.

The comparative yield of the bases isolated from five pounds of pancreas was as follows:

| | Fresh gland. Grams. | Digested gland. Grams. |
|---|---|---|
| Adenine | 4.0 | absent |
| Guanine | 2.6 | 0.20 |
| Hypoxanthine | trace | 0.56 |
| Xanthine | " | 1.20 |
| Uracil | 0.46 | 0.60 |
| Cytosine | 1.00 | 0.0 |
| Histidine | trace | trace |
| Arginine | 6.4 | 0.0 |
| Lysine | 4.8 | 0.0 |
| Putrescine | 0.0 | 0.5 |
| Ammonia | 6.06 | 10.06 |
| Total nitrogen | 48.44 | 57.68 |

The yields of bases, calculated for five pounds of spleen, were as follows:

| | Fresh gland. Grams. | Digested gland. Grams. |
|---|---|---|
| Adenine | 1.85 | 0.0 |
| Guanine | 1.10 | 0.0 |
| Hypoxanthine | 0.50 | 1.2 |
| Xanthine | 0.40 | 0.15 |
| Thymine | 0.40 | 0.38 |
| Uracil | .... | 0.45 |
| Cytosine | 0.30 | 0.0 |
| Histidine | trace | trace |
| Arginine | 3.2 | 1.5 |
| Lysine | 2.0 | 1.2 |

The yields of bases, calculated for five pounds of liver, were as follows:

| | Fresh gland. Grams. | Digested gland. Grams. |
|---|---|---|
| Guanine | 0.76 | trace |
| Adenine | 1.50 | 0.37 (crude) |
| Hypoxanthine | 1.10 | 0.30 |
| Xanthine | very small quantity | 0.30 |
| Arginine | 10.8 | 5.2 |
| Lysine | 12.96 | 4.0 |

F. P. UNDERHILL.

**On the Swelling of Organic Tissues. Researches on the Cornea.** BY G. BULLOT. *Am. J. Physiol.*, **12**, 297–304.—When the endothelium covering the posterior surface of the cornea is removed, the eyeball being kept entire, the corneal stroma swells considerably and becomes opaque. The swelling is due to the corneal stroma absorbing the aqueous humor filling the anterior chamber of the eye. Normally, this imbibition cannot take place on account of the impermeability of the living endothelium to aqueous humor. The epithelium covering the anterior surface of the cornea is also impermeable to water, but its removal is not followed by any absorption of liquid by the stroma. The cornea of the entire eyeball, with its epithelium scraped off, remains as thin and transparent as it is normally, whether the eyeball is left *in situ* with the eyelids opened or sutured, or is enucleated and transplanted into the peritoneal cavity. The present paper discusses the reason for this difference of action and shows that it is due principally to the action of the intraocular pressure, which does not prevent imbibition through the posterior surface, both forces acting in the same direction, but which opposes imbibition through the anterior surface. When the scraped eyeball is placed in blood serum or white of egg the cornea swells very slowly and moderately, less with the latter than with the former. If the eyeball, with corneal epithelium scraped off, is placed in solutions causing them to swell and become opaque and subsequently is placed in egg-white or blood serum solutions the cornea shrinks and becomes transparent. F. P. UNDERHILL.

**The Influence of Suprarenal Extract upon Absorption and Transudation.** BY S. J. MELTZER AND JOHN AUER. *Trans. Assoc. Am. Physicians*, 1904, 1–27.—The subcutaneous injection into frogs of a mixture of adrenaline (0.7 cc.) and strychnine (0.03-0.04 mg.) does not produce tetanus or death so quickly as an injection of strychnine alone. An injection of adrenaline followed by an injection of strychnine in a region somewhat remote from the region of the first injection does not cause this delay in frogs. With rabbits an intravenous or subcutaneous injection of adrenaline (1 cc.) is capable of overcoming or distinctly delaying and greatly mitigating the effects of a fatal dose of strychnine. A subcutaneous injection of adrenaline (2 cc.) in rabbits retards and diminishes the coloring of the skin and mucous membranes, due to a subsequent subcutaneous injection of fluorescein. The retarding effect is much stronger when the adrenaline is injected intravenously. The question of the influence of adrenaline upon the absorption of fluorescein by the blood was investigated with rabbits that had received subcutaenous injections of fluorescein and adrenaline. By testing for the appearance of fluorescein in the blood serum it was found that in the same length of time

after the injection of the fluorescein the test for the latter was much fainter in serum of the adrenaline animal than in the control, and the elimination of fluorescein from the blood of the adrenaline animal was much less rapid than it was from the control animal.

To test the influence of adrenaline upon the rate of transudation, solutions of sodium chloride were injected into the peritoneal cavity of rabbits. The animals were then given subcutaneous injections of adrenaline and intravenous injections of fluorescein. At intervals the sodium chloride solution was withdrawn and the appearance of fluorescein noted. It was found that a solution, taken from the peritoneal cavity of the adrenaline animal twenty-one minutes after the injection of fluorescein, was not as fluorescent as the solution taken from the control eight minutes after the injection. After nephrectomy the sodium chloride solution withdrawn from the peritoneal cavity of the adrenaline animal twenty minutes after the injection was equal in fluorescence to that taken from the control animal ten minutes after the injection of the fluorescein. The authors put forth the view that adrenaline has a retarding influence upon absorption and transudation, and their theory for this action is that the influence is exerted upon the endothelia of the blood capillaries and lymphatics causing an increase of the tonicity of the protoplasm, narrowing the lumen of the pores and decreasing the facility for the interchange between the blood and the tissue fluid (lymph). The extract decreases the vital permeability of the capillary walls, hence the retardation of absorption and transudation. F .P. UNDERHILL.

**Differences in Electrical Potential in Developing Eggs.** BY IDA H. HYDE. *Am. J. Physiol.*, 12, 241–276.—The difference of potential existing between two parts of the eggs (Fundulus, toad, turtles) was determined with a d'Arsonval galvanometer and also with capillary electrometers of the modified Lippmann, Porter and Lyon types. It was observed that there are differences of potential existing between the animal and vegetative poles of turtle's eggs. This difference increases with the development of the egg, and is probably the result of chemical or physico-chemical activity in the blastodisc area predominating over that of the vegetative pole. The records of experiments on an uncertain species of toad's eggs, several hours after fertilization, indicated a difference of electrical potential of a mean of 0.00002 volt, between the poles of an axis, at an angle to an axis directly through the pigmented and unpigmented regions of the egg. In tadpoles from eight to ten days old the difference of potential was about 0.0002 volt, and in a direction from the head to the tail of the embryo. Differences in electrical potential also exist between the animal and vegetative pole in the fertilized egg of Fundulus. During the phases of segmentation these potential differences appear in periods of rhythmical sequence

that are characterized by currents flowing for a definite time in one direction, gradually increasing to a certain limit and then decreasing, followed by a reversal of the current, which also increases gradually and then decreases. F. P. UNDERHILL.

**Metachromatism of Mast Cell Granules and Mucin.** BY G. H. A. CLOWES AND ALICE G. OWEN. *J. Med. Research*, **12** (New Series 7), 407-432.—The metachromatism exhibited by the granules of mast cells on staining with 10 per cent. polychrome methylene blue may be considered as a simple, acid-alkali reaction, the compound formed between the methylenazure of the stain and the granules being sufficiently sensitive to acids and alkalies to function as an indicator, in the strict chemical sense of the word. The granules exhibit a blue coloration with acids and a red color with alkalies. Oxidizing and reducing agents produce no marked color changes from red to blue, or *vice versa*; when stained, mast cells are submitted to their action. Reducing agents tend to decolorize the sections as might be anticipated. The granules are insoluble in weak acids, but readily soluble in weak alkalies. The globules of mucin present in the goblet cells of the intestinal mucosa stain faintly blue with dilute polychrome methylene blue, and show a tendency to red on treatment with acids.

F. P. UNDERHILL.

**On the Action of Oxygen at Low and High Pressure upon the Corneal Endothelium.** BY G. BULLOT. *J. Physiol.*, **31**, 359-365.—If the entire enucleated eyeball of the rabbit, with its epithelium scraped off, is placed in an atmosphere of moist air at 35° C. it is observed that, after fifteen hours, the endothelium which covers the posterior surface of the cornea is still living over the entire surface. If, instead of being exposed to ordinary air, the eyeball is placed in a mixture of 1 part air and 14 parts hydrogen, which is equivalent to air rarefied to 1/15, the endothelium after the same length of time is seen to be dead over the entire surface. The same result is obtained with pure hydrogen. When the air is less rarefied, only to 1/7 or to 1/10, the endothelium remains alive. At the periphery, however, it is found to be dead within a circular zone. The zone is broader in air rarefied to 1/10 than in the air rarefied to 1/7. The explanation is that the endothelium is killed by asphyxia, the tension of the oxygen being too low. When the entire eyeball of the rabbit is kept during fifteen hours or more at a temperature of 35° C. in pure oxygen at one atmosphere, the endothelium remains alive in its entirety. The same is true when the oxygen is compressed to 2.2 atmospheres. When the oxygen is compressed to 2.4 atmospheres the endothelium is partly killed, not the periphery as above, but in the center. When the oxygen is compressd to 3 atmospheres, the circle of dead endothelium is broader, leaving only a narrow zone of living endothelium at the

periphery. When the pressure of the oxygen is increased to between 3 and 4 atmospheres the endothelium is entirely killed.

F. P. UNDERHILL.

**The Domain of Physiology and Its Relations to Medicine.** BY S. J. MELTZER. *Science*, 20, 557–562. F. P. UNDERHILL.

**The Modern Conceptions and Methods of Medical Science.** BY W. T. COUNCILMAN. *Boston Med. and Surg. J.*, 151, 425–433.

F. P. UNDERHILL.

**The Blood in Pregnancy.** BY WILLIAM LAWTON THOMPSON. *Johns Hopkins Hosp. Bull.*, 15, 205–209.—As a result of studying the blood of twelve pregnant women it was found that a moderate decrease is observed in the red corpuscles rather early in pregnancy, remaining subnormal throughout the middle months, to rise again to normal at the termination of pregnancy; not, however, in all cases. A low percentage (67.5-68.8) of haemoglobin constant throughout the first seven months, rapidly approaches normal as pregnancy draws to a close. A slight absolute leucocytosis exists in every case of pregnancy, but this slight leucocytosis does not support the theory that it is due to any positive chemio-toxis. There is no variation from normal in the different forms of the white corpuscles. The specific gravity is high at the outset of pregnancy, diminishing by progressive steps to reach its lowest level in the middle months, rising to normal at term.

F. P. UNDERHILL.

**The Chemical Origin of Leucocytes.** BY E. SCHMOLL. *Johns Hopkins Hosp. Bull.*, 15, 238–247.—In this paper is discussed the question as whether the organism is able to synthesize the nuclein of its tissue cells, or is obliged to build them out of the cell material contained in the food. Since it would be practically impossible to carry out such an investigation on normal man, Scholl has experimented with leucaemia patients. He finds that as a result of albumin-rich diet the number of leucocytes is increased. The particular kind of albumin seems to have no particular influence on this new formation of leucocytes, for when a normal mixed diet was replaced by an albumin-rich, but purine-free, diet, the leucocytes rose from 26,500 to 46,500. Following the transition from albumin-rich, purine-poor diet to a purine-rich diet there followed a fall from 68,300 to 66,600. In the transition from purine-rich diet to purine-poor, but albumin-rich, diet there resulted a rise in leucocytes from 12,200 to 100,000. It is then plain that the organism builds up its leucocytes from whatever albuminous substances are introduced. F. P. UNDERHILL.

**Volumetric Determination of the Purin Bodies (Uric Acid and the Purin Bases) in Urine.** BY J. RUDISCH AND K. KLEE-

BERG. *Am. J. Med. Sci.*, **128**, 899–910.—The method outlined is as follows: To determine uric acid. To 110 cc. of urine add 55 N/50 silver solution and dilute with ammonium hydroxide (sp. gr. 0.90) to 220 cc. Mix and filter. Two portions of 100 cc., each of which corresponds to 50 cc. of urine, are collected. In the meantime a half-dozen small test-tubes are filled for about 1 cm. with a mixture of two parts of nitrous sulphuric acid and one part starch paste. To one of the above portions of 100 cc., N/50 potassium iodide is rapidly added, and after each addition of 2 cc. a small portion, not exceeding 0.5 cc., is removed by means of a pipette, which also answers as a stirring rod, and carefully introduced down the side of one of the test-tubes in such a manner that two absolutely distinct layers are formed. The end reaction manifests itself sharply by the formation of a blue ring (iodide of starch) at the point of juncture. The method is practically the same for the estimation of the purine bases, one point of difference being that the 110 cc. of urine is diluted to 220 cc. with water instead of with ammonium hydroxide. Solutions needed are N/50 silver solution, N/50 potassium iodide solution, a mixture of 25 cc. concentrated sulphuric acid with 75 cc. of water and 1 cc. fuming nitric acid. One cc. N/50 silver solution = 0.00336 gram of uric acid and 0.00152 gram purine bases, calculated as xanthine.
F. P. UNDERHILL.

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## SANITARY CHEMISTRY.

**Permanent Standards in Water Analysis.** BY LILY M. KENDALL AND ELLEN H. RICHARDS. *Tech. Quart.*, **17**, 277–280.—For Griess's test for nitrites a sample of Kahlbaum's aurine, 1.5 mg. per liter, gives a color which matches very well the 10 cc. standard nitrite. A sample of Kahlbaum's rosolic acid, 1.5 mg. per liter, to which has been added 0.008 mg. in aqueous solution of Kahlbaum's "malachite green," gives a color approximating very closely to 20 cc. standard. There are several commercial substances listed under "malachite green." The one used seemed to be "B," giving a blue aqueous solution. Standards for the Grandial and Lajoux nitrate test can be made from neutral potassium chromate used in the chlorine test. For deeper colors and ammonia, a solution containing 0.25 gram potassium bichromate and 9.05 grams cobalt sulphate per liter was found to be practicable.
LEONARD P. KINNICUTT.

**The Exact Examination of Atmospheric Carbon Dioxide. A Brief Survey.** BY A. S. WOODMAN. *Tech. Quart.*, **17**, 258–269.—A historical review of the methods used, the results ob-

tained and the sources of error in the determination of carbon dioxide in the atmosphere from the time that its presence in the atmosphere was demonstrated by Dr. Black, of Edinburgh, between 1753 and 1754, down to the present time. The processes used are divided into two groups: (1) Those in which a definite volume of air is taken for analysis; (2) those in which a large volume of air is aspirated through the apparatus. Each of these groups are subdivided according to the method employed. Under group (1) *Eudiometric.*—The direct measurement of the diminution of the air through absorption of the carbon dioxide. *Gravimetric.*—Determining the amount of barium carbonate formed. *Volumetric.*—Absorption of the carbon dioxide in a known amount of standard alkali and determining by titration the excess of alkali. Under group (2) *Direct weighing* of the absorption apparatus. *Titrimetric.*—Converting the barium carbonate formed from the hydroxide into chloride, and determining the amount of chlorine by titration with silver nitrate. *Volumetric.*—Measuring the volume of carbon dioxide set free by treating the barium carbonate formed with sulphuric acid. As a general conclusion, it is stated that, as far as our present knowledge goes, the average amount of carbon dioxide in fresh air is very close to three parts in 10,000, but from this average there is a constant variation, due to causes both local and general. LEONARD P. KINNICUTT.

**Notes on the "Hardness" of Water.** BY CHARLES R. WALKER. *Tech. Quart.*, 17, 281–283.—The method of determining the hardness of water by a standard soap solution gives good results only when the water does not contain soap curdling substances over 100 parts per million. With harder waters two methods of procedure are possible, to use a stronger soap solution, or to use a smaller volume of water than the usual 50 cc. The first method works fairly well, but with very hard waters there is still difficulty in determining the end-point, owing to the curd. Experiments, however, showed that the exact end-point could be determined within 0.05 cc. by sound, as the harsh sound as of solid and liquid is suddenly deadened as if oiled when the end-point is reached. It was also noticed that until the "earthy" salts were all precipitated by the soap the larger bubbles broke almost instantly and without iridescence, but when the soap was in slight excess, or the end-point was reached, the larger bubbles lasted from one to two minutes and showed marked iridescence. The second method, using less volume than the customary 50 cc., gave, with sound method, uniform results. The method of diluting a sample with distilled water gave less uniform results.

LEONARD P. KINNICUTT.

**The New Water Works at East Orange, N. J. (Illustrated).** *Eng. Record*, 50, 484–487.—The new system which has just been

completed consists of a series of artesian wells; a pumping station; a 24-inch riser-main, five miles long; a covered concrete steel reservoir; and a gravity distributing system. The number of artesian wells is twenty. They are mostly 6 inches in diameter, although a few are 8 inches and are from 75 to 110 feet deep. All have a static pressure sufficient to cause the water to rise from 16 to 20 feet above the surface, and they vary in flow from 500,000 to 750,000 gallons in twenty-four hours, the combined flow being about 7,500,000 gallons. The water is said to be very pure, but no analyses are given. LEONARD P. KINNICUTT.

**The Pollution of the Passaic River and Its Prevention.** BY ERNEST ADAM. *Municipal Eng.*, 27, 327–331.—The pollution of the Passaic River is principally below Paterson. Between Paterson and Newark Bay, 26½ miles, 70,000,000 gallons of sewage enter the river in twenty-four hours. This gives as the ratio of sewage to river water in the driest month of an average year 1 to 3.6 and in the wettest month, of an average year, only the ratio of 1 to 21.4. To remedy this pollution various commissions have been created and an outline of their reports is given. The last commission was appointed in 1902 and is known as the Passaic Valley District Sewage Commission, of which commission Mr. Rudolph Herring is the consulting engineer. The plan proposed by this commission is to construct a single trunk sewer from Paterson to Newark, and to have the outfall sewer discharge into upper New York Bay. The main sewer is designed for a daily flow at the discharge of 326,000,000 gallons when running only two-thirds full, the estimated population to be served being 1,617,000. The total estimated cost of the main and branch sewers, about 37 miles, including contingencies and supervision, is $8,691,400, and maximum estimated cost of maintenance is $544,500 per annum. The commission has not as yet begun any work as in 1903, Paterson, the second largest city in the district, contested the constitutionality of the various points in the act creating the commission. In July of this year the court declared the act constitutional in all its parts, but Paterson has appealed to the higher Court and a decision upon the appeal is not expected before the end of November. LEONARD P. KINNICUTT.

**Sewage Disposal.** BY J. N. MCCLINTOCK. *Municipal Eng.*, 27, 335–337.—Description of a small plant built for a summer cottage at Casco Bay consisting of a septic tank of 1,000 gallons capacity, a discharge chamber of 250 gallons capacity, connected with a Miller 6-inch automatic siphon, and a gravel filter 13 feet long, 10 feet wide and 5 feet deep. As a general rule, it is best in constructing bacterial filter-plants to build the tanks and filters in series so that alterations and repairs can be made without disturbing the whole system. LEONARD P. KINNICUTT.

**Sewage Disposal for Small Cities and Towns.** BY F. CHALKLEY HATTON. *Municipal Eng.*, 27, 331–335.—Land disposal is a system of discharging sewage at intervals upon broad areas of fairly porous ground for the purpose of inducing the growth of crops. There is no underdraining and the ground is expected to absorb all the sewage discharged upon it. It requires large areas of light sandy soil. The system should be a self-supporting one in the arid sections of this country, but could not be introduced elsewhere. *Surface irrigation* consists of preparing a sloping tract of sandy soil with a system of ridges from one and a half to two feet high, made of cinders, small stones, gravel or any available porous material. These ridges are built in parallel lines around the slope, and at the bottom of the slope is a collecting underdrain. The construction and operation of this system is very cheap, but the effluent obtained is of a very doubtful quality. The method has been tried with some success in California. *Broad irrigation* is of first importance as a method of sewage disposal for small cities and towns, because it is a system by which the manurial products of the sewage are used to enrich the soil. With ground fairly well located and of good texture the sewage of 65 persons can be treated on one acre, which can be prepared at a cost of approximately $1,250. This system, however, cannot be used in the middle or northern section of the United States on account of the winter climatic conditions, but the Gulf States are particularly well adapted for this method of disposal. Subsurface irrigation, consisting of laying lines of small tiles, the joints being left slightly open, a few inches under the surface of the ground to be irrigated, and underdrains, several feet under ground, the sewage being discharged into the upper tiles. The sewage from 100 to 200 persons per acre can then be treated, and the cost of preparing an acre of ground is about $1,600. This method can be used in somewhat colder climates than Broad Irrigation. *Intermittent Sand Filtration* is one of the most popular and successful systems in use. The cost of construction runs from $1,500 to $2,000 an acre; each acre can care for the sewage of 1,800 people, provided a surface area of one-half acre is provided to give the needed rest to the acre of beds. This method is applicable to a majority of places in this country, temperature having little effect upon its operation. *Chemical Precipitation.* This system is not only an expensive one to construct, but expensive to operate. The effluent obtained has not a high standard of purity. Disposal of the sludge is a troublesome item, and it has no commercial value. It cannot be recommended for small cities or towns. *Septic Tank Treatment.* When local conditions do not require a high or uniform standard of purity the septic tank in many cases is what the small city or town should adopt. Its installation is very cheap when compared with the cost of other

systems and the cost of operation probably nothing, and a community is often satisfied with the knowledge that their sewage or even the sewage of their neighbors, further up the stream, is being purified without troubling themselves as to the amount of purification. *Bacterial treatment* by single and double contact beds consists of discharging sewage upon prepared beds of clinker, cinders, coal, carbon, crushed stone or other porous material, the beds being from 3 to 7 feet in thickness. The system is well adapted to small cities and towns on account of low cost of installation and operation, the uniform standard of purity of the effluent, and as not requiring, when automatic siphons are used, regular attendance. One acre of double contact beds will satisfactorily treat the sewage of 2,000 persons, leaving one-fourth out of use for emergencies. *Electrical treatment,* consisting of adding to the sewage salt water containing hypochlorite of sodium formed by electrolyses, has been little used in this country, and no opinion can be given as to its worth. Which of the above methods can best be used by a given small city or town depends on local conditions, but the sewage of every community can be satisfactorily treated, the serious problem being only, which method is the best suited for the local conditions.

LEONARD P. KINNICUTT.

**The Sewage Testing Station at Columbus, Ohio (Illustrated).** BY JOHN H. GREGORY. *Eng. News*, **52**, 359–361.—In November, 1903, the City of Columbus voted the expenditure of $1,200,000 for the purpose of constructing a sewage disposal plant and of making the necessary improvements and extensions to the sewerage system. The engineers in whose hands the carrying-out of the work was placed considered it advisable, before deciding on what method of sewage disposal had best be employed, to ascertain, by a series of experiments on a practical scale extending over a period of one year, the most efficient and economical method of treating the sewage of the city, and were granted the sum of $46,000 for this purpose. A sewage testing station was, therefore, built in accordance with recommendations made by Mr. Hering and Mr. Fuller. The station, which is about 2 miles south of the city, consists of a pump chamber in the intercepting sewer, a pump house, screen chamber, two grit chambers, one plain settling tank, two chemical precipitation tanks, two septic tanks, two intermediate settling tanks, two primary contact beds of broken stone, four secondary contact beds of coke, two coke strainers, four sprinkling filters of broken stone, twenty-one intermittent sand filters, one reserve filter and a laboratory. The pump chamber is built in the intercepting sewer at the bottom of an existing manhole and the amount of sewage used for the various experiments is 350,000 gallons per twenty-four hours. The following

methods of treating sewage are being tried, the sewage in all cases being passed through a grit chamber:

(*a*) Straining through coke. (*b*) Intermittent sand filtration. (*c*) Double contact bed treatment. (*d*) Percolation. (*e*) Sedimentation and intermittent sand filtration. (*f*) Chemical precipitation and intermittent sand filtration. (*g*) Septic tank treatment, eight hours, and intermittent sand filtration. (*h*) Septic tank treatment, sixteen hours, and intermittent sand filtration. (*i*) Single contact bed treatment, followed by sedimentation and intermittent sand filtraton. (*j*) Percolation followed by sedimentation and intermittent sand filtration. (*k*) Sedimentation and percolation. (*l*) Straining through coke and intermittent sand filtration. (*m*) Straining through coke and single contact treatment.

LEONARD P. KINNICUTT.

**Report of the English Committee Appointed to Consider the Standardization of Methods for the Bacterioscopic Examination of Water.** *Chem. News*, 90, pp. 177–178 (1904).—At the congress of the Royal Institute of Public Health, held in Liverpool, 1903, a committee was appointed to draw up a scheme of uniform procedure for the bacterioscopic analysis of water. The report of this committee has just been made and in outline is as follows: The samples should be collected in sterile glass-stoppered bottles having a minimum capacity of 60 cc., and unless examined within three hours of collection the sample must be packed in ice. The minimum number of tests should be (*a*) Enumeration of the bacteria present on a medium incubated at from 18°-22° C.; (*b*) search for and enumeration of bacillus coli; (*c*) enumeration of the bacteria present on a medium incubated at blood heat, 36°-38° C.; (*d*) search for and enumeration of streptococci. For enumeration at 18°-22° C. a nutrient gelatine should be employed; for enumeration at 36°-38° a nutrient agar should be used, a distilled water gelatine, and a distilled water agar media is also desirable, as the comparison between cultures given in distilled water media and those given in nutrient media gives useful indications.

*Distilled Water Gelatine.*—Ten per cent. gelatine in distilled water and brought to a reaction of +10 (Eyre scale).[1] *Nutrient Gelatine.*—Ten per cent. nutrient gelatine made with beef infusion and Witt's peptone and brought to a reaction of +10. *Distilled Water Agar.*—One and a half per cent. powdered agar brought to a reaction of +10. *Nutrient Agar.*—Same constituents as nutrient gelatine, but substituting 1.5 per cent. of powdered agar for the gelatine. Reaction +10. The amount of media used should be 10 cc., amount of water 0.2 cc., 0.3 cc., and 0.5 cc. for an or-

[1] +10 Eyre scale is that each liter of medium has an acidity equal to 10 cc. of a normal acid solution. The report of the Committee of the American Public Health Association on Standardization of Method of Water Analyses is given in this Journal, R, 24, p. 36.

dinary water with gelatine media, 0.5 cc. and 1 cc. for agar, counting to be done with naked eye, any doubtful colony being determined with aid of a lens. Gelatine plates to be counted at the end of seventy-two hours, but inspected daily in order that the count may be made earlier, should liquefaction render it necessary. Agar plates to be counted at end of forty to forty-eight hours. *Search for Bacillus Coli.*—Fifty cc. should be the minimum quantity of water examined for the presence of bacillus coli, quantities from a minimum of 0.1 cc. to 25 cc. being added to the tubes of culture media, and the glucose broth method of Pakes, or the bile broth method of McConkey should be used, best at the temperature of 40° C. If indications of the presence of bacillus coli are thus obtained, it must be isolated and identified. The isolation may be done by surface cultures in plates of either litmus lactos agar, reaction +10, bile salt agar, nutrose agar of Conradi and Drigalski, or ordinary nutrient gelatine. The best of all these is probably the nutrose agar. For the identification of the bacillus coli the following sub-cultures should be made: (*a*) Surface agar at 37° C., (*b*) surface and stab cultures in gelatine, (*c*) litmus milk incubated at 37° C., (*d*) glucose litmus medium, (*e*) lactose litmus medium, (*f*) peptone water for indol reaction. The typical bacillus coli must conform to the following description and test: Mobile, non-sporing bacillus, growing as well at 37° C. as at 18°-22° C., decolorized by Gram's method of staining, not liquefying gelatine, tubes being kept for ten days in order to exclude a liquefying bacillus, forming thin smooth growths on gelatine, also growing to the bottom of the stab, producing permanent acidity in milk, curdling it within seven days at 37° C., fermenting glucose and lactose with the production of acid and gas, sometimes (about 50 per cent.) fermenting saccharose, changing neutral red (Grubler's), reducing nitrates, and producing a gas from glucose, half of which is absorbed by potassium hydroxide solution. These last tests should be made if time and opportunity permit. *Streptococci.*—These should be looked for by making hanging-drop preparations of the fluid media employed for the preliminary culture of the bacillus coli and their presence or absence should be stated. The streptococci should be isolated on nutrose agar plates and their characters determined. The committee recognizes that a typical bacillus coli is met with, but makes no suggestion as regards its significance. LEONARD P. KINNICUTT.

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## AGRICULTURAL CHEMISTRY.

**The Hydrolytic Enzyme Contained in Castor Oil Seeds.** BY W. H. WALKER AND L. M. BOURNE. *Tech. Quart.*, 17, 284.—

The authors investigated the fat-splitting enzyme of castor beans with a view to its utilization for the commercial hydrolysis of fats and oils, as suggested by Connstein, Hoyer, and Wartenberg (*Ber. d. chem. Ges.*, 35, 3988). They attempted to use press-cake from the manufacture of castor-oil, but found that the enzymes had been killed by the heat employed in the process of extracting the oil. The hydrolytic power was found to be lessened by the germination of the seed. Efforts to separate the enzyme from the seed and prepare a concentrated solution were unsuccessful. It is suggested that the chief difficulty in using the enzyme commercially lies in the preparation of a perfect emulsion. The difficulties of emulsification increased as the amount of material operated upon grew larger, but it is suggested that the utilization of this vegetable enzyme is a promising field for further endeavor. W. D. BIGELOW.

**Vinegar and Molasses.** BY A. L. WINTON. *Conn. Agr. Expt. Sta. Ann. Rpt., 1903*, p. 156.—Of the 463 samples of vinegar examined, 83 were found to contain less than 4 per cent. of acetic acid, which is the minimum limit prescribed by law. Of the 414 samples of molasses examined, 15 were adulterated by admixture of glucose. W. D. BIGELOW.

**Chocolate and Other Products of the Cocoa Bean.** BY A. L. WINTON, E. MONROE BAILEY, AND M. SILVERMAN. *Conn. Agr. Expt. Sta. Ann. Rpt., 1903*, p. 123.—Forty samples of cocoa products classified as follows were examined during the year:

| | Plain. | Sweet. | Total. |
|---|---|---|---|
| Chocolate not found adulterated | 6 | 12 | 18 |
| Adulterated chocolate | 8 | 3 | 11 |
| Compound chocolate | 5 | 2 | 7 |
| Chocolate and cocoa containing milk or casein | 1 | 3 | 4 |
| Total | 20 | 20 | 40 |

The report includes a brief statement of the methods of manufacture of cocoa products, the full analysis of the 40 products examined, and a detailed description of the methods employed in the examination. *Water, ash, soluble ash,* and *ash insoluble in acid* were determined by the usual methods. The *alkalinity of the ash* was determined by Ewell's method (U. S. Dept. Agr., Div. Chem., Bull. 13, Part 7, 956). *Theobromine and caffeine* were determined by the Decker-Kunze method (*Schweiz. Wchshr. Pharm.*, 40, 527-530, 541-545, 553-557 (1902); Abstract *Chem. Centrbl.*, 74, 62 (1903)). The *amount of other nitrogenous substances* was calculated by subtracting from the total nitrogen the sum of the nitrogen present as theobromine and caffeine.

*Crude Fiber* was determined by the method of the Association of Official Agricultural Chemists, except that the fiber was filtered and weighed on a filter-paper instead of a Gooch crucible.

*Crude Starch* (copper-reducing matters by direct inversion calculated as starch).—Four grams of the unsweetened, or 10 grams of the sweetened product, were freed from fat by repeated grinding in a mortar with successive portions of ether, transferred to a filter-paper and washed with ether. In case of sweetened products the fat-free material was transferred again to a mortar by means of a jet of cold water and rubbed to an even paste. The mixture was transferred to a filter and repeatedly ground with water and filtered until free from sugar. The insoluble material was then hydrolyzed by the Sachsse method (*J. prakt. Chem.*, N. F., **22**, 52 (1880)) and the resulting glucose determined as usual.

*Pure Starch.*—The material was freed from salt and sugar, as described under crude starch, and the starch determined by the usual diastase method.

*Fat.*—Any of the ordinary continuous extractors is employed with 2 grams of the material after drying the latter for three days in a sulphuric acid desiccator.

*Sugar.*—Half the normal weight is freed from fat with absolute ether and the soluble residue after evaporation of the ether taken up with water, clarified with basic lead acetate and alumina cream, the mixture made up to a definite volume, shaken and filtered. The volume of the precipitate is determined by placing the insoluble matter in a 50 cc. flask after washing several times with cold water and drying thoroughly at 120°. Water is then added from a burette and heated rapidly to boiling to liberate air bubbles, the heating being discontinued as soon as the boiling-point is reached. The contents of the flask are then cooled and made up adulterated. W. D. BIGELOW.

**Lard.** BY A. L. WINTON AND A. W. OGDEN. *Conn. Agr. Expt. Sta. Ann. Rpt., 1903*, p. 149.—Of the 130 samples sold as lard examined during 1903, 63 samples, or 48.8 per cent., were adulterated. W. D. BIGELOW.

**Ground Coffee.** BY A. MCGILL. Laboratory of Inland Revenue Department, *Bull. No. 100.*—The bulletin gives the results of the examination of 72 samples of ground coffee, 45 of which were pronounced genuine, 19 adulterated, and 8 doubtful. In addition to these, 3 samples of coffee mixed with substances declared on the label were also examined. The examinations include the microscopical examination, determination of specific gravity, of 10 per cent. extract and iodine reaction for starch.

W. D. BIGELOW.

**The Rape Plant (Brassica Napus).** BY J. H. GRISDALE. *Can. Cent. Expt. Farm Bull. 42.*—The rape analyzed was found to contain 87 to 94 per cent. $H_2O$, and more protein than does clover. The nutritive value of the digestible constituents was 1 : 3.37. J. A. LECLERC.

**Alfalfa or Lucern (Medicago Sativa).** BY F. T. SHUTT. *Can. Cent. Expt. Farm Bull. 46, Part II.*—The comparative composition of alfalfa and of ordinary fodders is given, showing that the legumes are more nutritious, weight for weight, than the grasses, corn or roots.

Comparison tests were made of cutting alfalfa twice and four times, respectively, during the season with the following results:

| | Two cuttings. Tons. | Four cuttings. Tons. |
|---|---|---|
| Weight of crop | 16.9 | 19.4 |
| Weight of dry matter | 4.4 | 4.2 |
| Weight of protein | 0.7 | 0.8 |

The alfalfa cut four times contained more moisture. The later the cutting the more dry matter and the more albuminoids, *i. e.*, 1 ton of the fourth cutting contains as much albuminoid as 1½ tons of the first cutting. J. A. LECLERC.

**Cow Peas.** BY G. W. CARVER. *Ala. Tuskegee Expt. Sta. Bull. No. 5.*—The author compares, through their chemical composition, cow-peas with beans as a food for man, and gives a score or more recipes for the preparation of cow-peas for human consumption. J. A. LECLERC.

**Commercial Feeding-stuffs in the Connecticut Market.** *Conn. Agr. Expt. Sta. Bull. Nos. 141 and 145.*—These bulletins contain the analyses of over 300 feeding-stuffs sold in Connecticut. The digestibility coëfficients of the food ingredients of many of the ordinary feeding-stuffs are given. Chemical analyses show that for the most part the composition of the feeds which have guarantees is in agreement with the analyses. Warning is sounded against the purchase of several adulterated brands. A discussion of the functions performed by each of the food constituents is given. J. A. LECLERC.

**Taylor's Absorption Process for Butter-making.** *J. Frank. Inst.*, September, 1904, p. 233.—This process is for the rapid separation of fat from the other constituents of sweet cream. This is done by absorbing the watery solution by means of blotting-paper. The fat layer can then be easily separated from the moist paper. Analysis of the fat layer showed it to contain 79.5 per cent. fat, and 2.5 per cent. casein. By working and washing this fat layer the per cent. of fat rises to 83, while that of casein falls to a little over 1. The Reichert-Meissl No. is 30.3. "The layer of fat stands, therefore, intermediate between a Devonshire clotted cream and a true butter." The John Scott Legacy Medal and Premium was awarded the inventor by the Franklin Institute.

J. A. LECLERC.

**On the Analysis of Cheese.** BY THOMAS MACFARLANE. *Trans. Roy. Soc. Can.*, 1903, Section 3, p. 3.—(1). The cheese is mixed intimately with asbestos, placed in an extraction tube and heated at 98° for the determination of water.

(2) Fat is determined by extracting the water-free cheese three to four hours with low-boiling petroleum ether. The tube is again heated to 98° and the fat percentage obtained by loss of weight.

(3) The same sample is then extracted with 92 to 95 per cent. alcohol by volume and the amount removed found as above, by loss of weight.

(4) It is then extracted with boiling water. The per cent. removed is found again by loss of weight.

(5) The residue is assumed to consist mainly of unaltered casein.

The sum of results 3, 4 and 5 is called caseids. The same result is obtained by subtracting the sum of 1 and 2 from 100. Caseids also include ash.

The sum of 3 and 4 represents the caseones, a term applied by Duclaux to indicate the products of ripening. As this contains not only most of the ash, but also the salt added in the process of making, the author proposes to apply the term caseone to the alcohol extract only, and to let this result be the index of the degree of ripening.

The alcohol-soluble caseone varies from 24 per cent. in Canadian cheese to 59 per cent. in Camembert.

The factor 6.35 (average of Chittenden-Hammarsten) is used in calculating casein. J. A. LECLERC.

**Tannin.** Proceedings, First Annual Convention American Leather Chemists' Association, St. Louis, September 26 and 27, 1904. *Hide and Leather*, October, 1904—The report of the referee of the Association of Official Agricultural Chemists on tannin, read before the convention, showed that with chestnut extract the differences among the results of the analyst were not greater practically on soluble solids, non-tannin and tannin than on total solids. On soluble solids and tannin they were much greater with hemlock extract, and on non-tannin greater with quebracho extract.

The temperature at which filtrations for soluble solids are made affects this determination seriously, a difference of 15°, giving differences of from 1 to 1.5 per cent.

Attention was called to the fact that not all the material or "reds" dissolved at higher temperatures is absorbed by hide, that is, that a portion of the "reds" are not tannin.

The results of work on barks and woods showed wide differences—as high as 6 per cent. tannin on hemlock bark. Such differ-

ences are probably due to differences in quantity of material taken, volume of extract and time of extraction.

Much dissatisfaction was expressed with all the common forms of extractor now used and the desirability of an extractor in which the boiling of the extracted material is reduced to a minimum was emphasized.

The work on the determination of acids in tan liquors showed that the hot charcoal method gives results that are low, but closer to theory than are obtained in the cold. Shaking is of no advantage except in giving quick results. Concentration of tan liquors affects the results. The more charcoal used the greater the minus error.

Special precautions taken to prevent loss by evaporation during filtration gives 0.22 per cent. less soluble solids on chestnut extract, 0.33 per cent. less on hemlock and 0.01 per cent. less on quebracho. These are average figures of nine analysts.

Papers were read on "The Parker-Payne Method for Estimating Tannin," on "Applied Chemistry in the Manufacture of Leather," on "Analyses of Spent Bark," and on "The Analysis Dilution of Extracts." F. P. Veitch.

**Poison in Water from a Gold and Silver Mine.** *Utah Agr. Expt. Sta. Bull. 81.*—A water from a tail race of a gold and silver mine, which killed almost immediately cattle which drank it, was found to contain lead (as metal), 35 parts per 100,000; copper (as metal), 4.1 parts; arsenic (as trioxide) 166.6 parts per 100,000. F. P. Veitch.

**A New Centrifugal Soil Elutriator.** *Utah Agr. Expt. Sta. Bull. 89.*—The article gives a description of apparatus, a method for calculating formulae for determining the speed of machine and of the flow of water, and experimental results obtained with the apparatus. Duplicate determinations showed differences as great as 4 per cent., though most differences were less than 2 per cent. It appears necessary to re-elutriate the first or coarsest sediment at least once, as much of the finer soil remains in it. F. P. Veitch.

**The Relation of Smelter Smoke to Utah Agriculture.** *Utah Agr. Expt. Sta. Bull. 88.*—See this *Rev.*, 27, R.

F. P. Veitch.

**Sanitary Conditions in the Home and on the Farm.** *S. C. Agr. Expt. Sta. Bull. 89.*—A popular discussion of well-known causes of insanitary conditions of foods, waters, etc., and of corrective and preventive measures. F. P. Veitch.

**An Artificial Root for Inducing Capillary Movement of Soil Moisture.** BY L. J. BRIGGS AND A. G. MCCALL. *Science*, **20**, pp. 566–569.—The artificial root described consists of a Pasteur-Chamberland filter-tube connected to an exhausted 2-liter bottle. A core of soil somewhat smaller than the porcelain tube is removed and the tube forced into the hole, thereby establishing a good capillary connection beween the walls of the tube and the soil. The bottle is removed once every twenty-four hours and the solution, supplied to the tube by the soil, measured.

This apparatus avoids the errors and difficulties of other devices used to create a pulling force in the soil analogous to the action of the plant root, whereby "the rate at which a given soil, with a given moisture content, is able to supply moisture to the roots of a plant" can be determined.

The solution obtained is apparently identical with the soil solution from which the plant gets its food and the method, therefore, affords a means of studying the composition of soil solutions under field conditions. The apparatus will not work, however, under conditions approximating a drouth. J. H. PETTIT.

**An Artificial Root for Inducing Capillary Movement of Soil Moisture.** BY F. H. KING. *Science*, **20**, 680–681.—The author does not agree with the statement made in *Science* (October 28, 1904) that the results observed in the artificial root were due to capillarity.

The two statements, that "when a tube of this kind is moistened so that the pores are filled with water and the tube is protected from evaporation, it can be exhausted to a pressure equal to the vapor pressure of water and, if connected to a 2-liter receiver, it will maintain that pressure for a day or more without sensible loss," and that such "a tube, in good condition, when immersed in water and exhausted, will take up water at the rate of 50 grams per minute," together with other evidence presented, indicate that the effect is due to percolation, induced by the partial vacuum existing in the tube.

Supersaturation of the outer wall of the filter is necessary to cause a flow into the tube and this condition can be maintained for days, not by capillarity alone, but by atmospheric pressure, which permits the soil air to sweep more water toward the filter and so to keep the outer wall well moistened. When the soil is left open by the removal of the water, air comes in contact with the outer wall and the condition described in the first quotation results.

It is doubtful, too, if the concentrations of solutions so procured are the same as those which closely invest the soil grains and root hairs at the same place and time. Such a filter will probably change the concentration of small quantities of some solutions.

J. H. PETTIT.

## PATENTS.

MAY 31, 1904.

761,123. Hugo Witter, Elberfeld, Germany. **Red azo dye.** Assigned to Farbenfabriken of Elberfeld Co., New York, N. Y. Naphthol sulphonic acids are caused to react on diazotized $\alpha$-aminoanthraquinone, the alkaline salts forming red-brown to brown powders, soluble in water yellowish red, and forming blue to brown-red lakes with alkaline earths.

761,164. Wm. E. Greenawalt, Denver, Colo. **Extracting metals.** Chlorine is generated by the electrolysis of sodium chloride and absorbed in water, the solution and the ore is agitated in a closed vessel from which the solution now containing the metal is displaced by a fresh charge of liquid, and the metal precipitated.

761,188. Thomas B. Aldrich, Detroit, Mich. **Halogen tertiary butyl alcohol.** Ketones are made by distilling salts of the monobasic fatty acids, then halogenized, as by adding acetone to an aqueous solution of chloride of lime, then adding caustic alkali to form the alcohol.

761,203. Robert S. James and Frederic R. Carmichael, Paris, France. **Finishing textile fabrics.** Casein just neutralized by sodium carbonate is added to an aqueous soap solution, with sufficient tallow and clay, or other suitable material to finish and load the fabric.

761,260. Wilhelm Sternberg, Berlin, Germany. Assignor to Chemische Fabrik vorm. E. Schering, same place. **Formaldehyde compound.** Formaldehyde solution is caused to react on wood tar equal parts, making a brown powder, non-irritating, insoluble in water, soluble in acetone, chloroform and glacial acetic acid, less readily soluble in methyl and ethyl alcohol or benzene. Used in skin diseases.

761,265. Charles E. Swett, Providence, R. I. Recovering **wool fat.** One-half assigned to Robert H. Hutchinson, New York, N. Y. An alkaline manganate is added to wool wash-water till the color disappears, then acid is added till the fat rises and curds and the fat is then removed.

761,284. Max Buchner, Mannheim, Germany. Assignor to F. Bohringer Soehne, Mannheim-Waldorf, Baden, Germany. **Reducing nitro compounds.** Amines are made by putting the corresponding nitro body into a hydrochloric acid electrolyte in which is arranged a lead cathode, and passing the current, stirring and cooling. See patent 700,670 for similar process with tin.

761,310. Walter Loeb, Bonn, Germany. Assignor to F.

Bohringer Soehne, Mannheim-Waldorf, Baden, Germany. **Azo dye.** A mixture of "Ponceau 2G" aniline 10, $\beta$-naphthol-disulphonic acid 32.7, potassium nitrite 9.1, and water 100 parts are electrolyzed in the presence of a platinum cathode.

761,369. Barbara J. Francis, New York, N. Y. **Pipette.** A suitable tube is fitted with two movable rubber rings to show the depth of immersion and the height of the fluid sucked up.

761,374. Wm. A. Hall, Bellows Falls, Vt. **Enameling composition.** Alkali casein, soluble starch, and china clay in water in the desired proportions are mixed.

761,387. Eudo Monti, Turin, Italy. **Concentrating wine.** The water in wine is frozen and the residual wine, stronger in alcohol, is displaced by ice water from a previous operation.

761,403. Albert H. Robinette, Fostoria, Ohio. **Gunpowder.** Salts of potassium, *viz.*, nitrate, ferrocyanide, yellow prussiate, and granulated sugar.

761,412. Hermann Schrader, Honningen, Germany. **Organic acid from beet-root molasses.** The vinasse is concentrated, sulphuric acid added to neutralize the alkali, the potassium sulphate separated, and the liquor bleached.

761,440. Augustus Bischler, Basle, Switzerland. Assignor to Basle Chemical Works. **Indoxyl,** etc. Alkali salts of arylglycines, caustic alkalies, metallic sodium, and the reaction product of sodium on potassium alcoholate are mixed at 220° to 240° C.

761,542. Georges Reynaud, Paris, France. **Achroö-dextrin.** An acid peat is heated with three to five times its weight of water under low pressure to 110° to 150° C. half an hour to an hour to convert the amylaceous matters to achroö-dextrin.

JUNE 7, 1904.

761,641. George F. Atwood, Wakefield, Mass. Assignor to Primary Power Co., same place. **Battery fluid.** Ammonium carbonate 24, sodium carbonate and mercury bisulphate 10 each, water 3840 parts and sulphuric acid enough to make the solution 1.2 specific gravity.

761,642. **As above.** Sodium nitrate 7, nitric acid 142, water 112, and sulphuric acid enough to make the specific gravity 1.2.

761,788. Frederick M. Ruschhaupt, Milwaukee, Wis. **Artificial slate.** Asphalt 5, asphalt oil 4, sand 25, clay 50, talc 10, fiber 4, and aluminum resinate 2 parts by weight.

761,854. Charles Shipp, London, England. Assignor to Benjamin Franklin Nichols, same place. **Covering for drawing rolls.** Chinese wood oil is ground up with cork and rolled onto a textile backing.

761,870. Arthur W. Baxter, London, England. **Fire-proof-**

**ing solutions.** Silica is fused with the carbonates of sodium and potassium, the mass dissolved in hot water, ammonium sulphate added and sulphuric acid enough to neutralize the mixture.

761,900. Newton J. Norman, Jacksonville, Fla. **Flux.** Pulverized glass, saltpeter, and sal soda 3 parts each, sal ammoniac and yellow potassium prussiate 4 each, and borax 5 parts. Used for welding copper.

761,939. Frederick Boleg, Esslingen, Germany. Assignor to Gesellschaft zur Verwertung der Bolegschen wasserlöslichen Mineral Oele, etc. **Water solutions of mineral oils.** A mixture of mineral oil and crude anhydrous rosin oil is steamed and boiled, lye added, the oil separated from the soap-lye and treated with compressed air and water.

761,946. Lloyd Conner, Caro, Mich. **Blackboard composition.** Calcined plaster 20, Portland cement 10, emery powder 1 part, and water and chrome salt for a color.

761,957. Wilbur S. Gould, Deepriver, Iowa. Assignor one-half to F. W. Harwood, Cedar Rapids, Iowa. **Renovating cream.** Sour cream is diluted with water, at a pasteurizing temperature, separating the emulsified butter fat and water from the other constituents, separating the butter-fat from the water, and emulsifying the fat with fresh milk.

761,998. Eduard Ritsert and Wilhelm Epstein, Frankfort-on-Main, Germany. Assignors to Meister Lucius und Bruning, Hochst-on-Main, Germany. **Alkyl esters of 3-4-diamino benzoic acid.** White, easily crystallizable substances, soluble in alcohol and ether, derived from 4-amino benzoic acid by esterification and nitration and reduction, the nitration taking place after the conversion of the amino group into an acylamino group, and the reduction after elimination of the introduced acyl group.

762,000. Chas. E. Sackett, Fall River, Mass. Assignor to Old Colony Hat Co., same place. **Renovating old hats.** They are first rolled in damp sawdust, washed first in ammonia, then in warm water, immersed in caustic soda, squeezed, and treated with a bath of sulphuric acid.

762,026. Wilhelm Connstein, Charlottenburg, Germany. Assignor to Vereingte Chemische Werke Actien Gesellschaft, same place. Making **fatty acids.** Fatty acid esters, as tallow, spermaceti, etc., are emulsified in free acid, as acetic or sulphuric, and fermented with Ricinus seed ferment.

762,032. Ferdinand Evers, Dusseldorf, Germany. **Extracting dried liquorice root.** It is powdered, boiled with water, filtered, oxide of iron added to the filtrate, concentrated, the iron dissolved by sodium carbonate, and again heated and concentrated.

762,139. Oma Carr, Buena Vista, Va. **Paper pulp and**

**tannin.** The wood is chipped, the soluble tannin leached out by diffusion, and the exhausted chips made into paper pulp.

762,227. Henry Blackman, New York, N. Y. **Anode.** The exterior of the anode is of dense, impermeable, magnetic iron oxide, having a protecting layer of glass or vitreous glaze fused to it in a band around that part exposed at the surface of the electrolyte.

762,229. Giovanni Cornari, Mantova, Italy. **Explosive cartridge.** An electrolytic cell whose metallic walls form a cathode, and contain an alkaline solution, an anode in said cell free of the cathode, and adapted to electrolyze the solution, a gas check connected to the anode and a metallic wire in said cell adapted to be rendered incandescent to explode the electrolytic products.

762,256. Robert Schneider, Berlin, Germany. **Tuberculosis medicine.** Powdered eucalyptus leaves 7.5, oil of *eucalyptus maculata* 4.5, flowers of sulphur 63, and powdered charcoal 25, mixed and burned to produce a vapor for inhalation.

JUNE 14, 1904.

762,303. George O. Gilmer, New Orleans, La. **Distilling wood.** Assigned to Illinois Investment Co., West Va. The wood is placed in a closed receptacle and heat applied to the top, gradually extending down through the wood and drawing off the different vapors successively as formed.

762,446. Wm. M. Spore, Argenta, Ill. **Explosive.** Corn pith 2.5, potassium chlorate 1 part by volume, and nitrated turpentine made by mixing turpentine and nitric acid sufficient to form a plastic mass, that is dried and ground.

762,447. Everard Steele, Mill Valley, Cal. **Explosive.** Nitrated phthalic acid and potassium chlorate, the latter granulated and coated with the first.

762,547. Henry C. Milligan, Canton, Ohio. **Enameling steel ware.** The articles are first pickled, washed and dried, then immersed in weak acid and while wet coated with an alkaline liquid enamel, then dryed, and fused in a muffle.

762,635. Lindsay R. Hurst and George H. Beecham, Louisville, Ky. **Incrustation preventive.** Water 450, extracts of chestnut-oak bark, black oak bark, red oak bark, and burnt sugar 50 each, alcohol 25 parts by volume.

762,718. George K. Hollister, Jr., New York, N. Y. **Artificial fuel.** Anthracite culm 70, and a pulverized bituminous coking coal 30 parts, are mixed with sufficient binder of water 120, ammonia 15, resin 75, and alum 70 parts, all coked together till the water is almost gone, then molded and the baking finished.

762,757. Francis L. Du Pont, Wilmington, Del. Purifying **nitrocellulose.** The nitrocellulose is washed with a stream or

jet of water holding a gas in solution, whereby the gas is caused to bubble through the material.

762,765. Richard Schmidt, Holxminden, Germany. Assignor to Haarmann and Reimer, same place. **Homologues of isoionone.** A mixture of isomers of cyclic citral and homologous ketones is treated with condensing agents as sodium alcoholate, producing homologues of cyclic $\beta$ or isoionone having the odor of violets.

762,834. Georges R. De Montlord, New York, N. Y. **Sizing for fabrics.** Meal from barley 10, sweet almonds 20, linseed 30, and castor oil beans 10, olive oil 20, oxygenated water 10, all liters, and sulphuric acid 2 cc. are boiled in 2000 liters of water a half hour.

762,843. Raymond B. Price, Chicago, Ill. **Devulcanizing rubber.** The shredded rubber is mixed with a saturated alkaline solution and digested under high heat.

JUNE 21, 1904.

762,866. Henry A. Allen, Chicago, Ill. **Ore separator.** A closed vessel with conical ends has a fluid supply at the top, and an opening for ore supply at the bottom with numerous small inflow jets around the bottom arranged stepwise, the separation being effected by differences of gravity.

762,867-8-9 and 862,870 all **as above** for combinations of said vessel with gas and liquid supplies under pressure, receiving vessels for the varied products, and connecting pipes.

762,897. Witold Gawlikowski, Jaroslow, Austria-Hungary. **Incrustation preventive.** Powdered carbon or coal dust is fed under pressure into the boiler on the incrusted walls that are then flushed.

762,915. Eugen Kuthe, Frobein, Germany. Assignor to Frambs and Freudenberg, Schweidnitz, Germany. Apparatus for making **lime sucrate.** A large vertical, dust feed pipe with screw feed is mounted in a cylinder surrounded with small liquid feed pipes adapted to mix a dust with a liquid.

763,003. Rudolf Kobert, Rostock, Germany. Assignor to E. Merck, Darmstadt, Germany. Making **saponin.** Guaiac extract containing an acid and neutral saponin is treated with lead acetate which precipitates the acid saponin as a lead salt, the filtrate is treated with lead subacetate which throws down the neutral saponin to which is added hydrogen sulphide and the neutral saponin is isolated.

763,026. Wm. J. Schweitzer, White Plains, N. Y. Apparatus for **treating sewage.** A separating and a settling tank, connected with an electrolyzer, means for supplying chemical precipitants to the electrolyzer and a filter.

763,053. Hans A. Frasch, New York, N. Y. **Recovering nickel hydroxide.** Nickel-ammonium chloride is suspended in a solution of calcium chloride and heated to precipitate nickel hydroxide, filtering and adding a suitable reagent to precipitate the residual nickel, then recovering the ammonia by adding calcium hydroxide and distilling off the ammonia.

763,277. Wm. L. Gile, Muskegon, Mich. **Composition packing.** Globules of lead, tin, and antimony are mixed with binder strips of the same metals and with asbestos and graphite.

763,320. Alcide F. Poirrier, Paris, France. Assignor to St. Ame des Matieres Colorantes de St. Denis, Paris, France. **Blue sulphur dye.** Dimethyl-*p*-phenylenediamine and phenol are oxidized together and heated with alkaline sulphide and then with the product of the reaction of sulphur chloride on a phenol.

JUNE 28, 1904.

763,347. Otto F. Amend, New York, N. Y. **Bating skins.** The hides are first treated with an ammoniacal salt in solution' and then with successive small quantities of hydrochloric acid to remove the hair.

763,383. David Feldhamer and Nathan Oelgiesser, New York, N. Y. **Artificial marble.** Slaked lime 6, coal ashes 15, zinc white 6, zinc chloride 3, and chrome alnm 1, baked and soaked in a solution of tartar 4, borax 1, and water 40 parts.

763,421. Frederick A. Pank, Butte, Montana. **Acid-proof paint.** Water 40, linseed oil 130, india rubber 8, resin 4, beeswax 10, silica 50, red lead 30, gypsum 50 parts by weight.

763,450. Edward F. Wright, Austin, Texas. **Fertilizer.** Iron sulphate 100, lime superphosphate and kainite 200 each, mixed and ground.

763,472. Malcolm F. Ewen and George H. Tomlinson, Chicago, Ill. **Sugar from cellulose.** The cellulose is digested in a closed vessel with vaporized sulphurous acid at 120° to 160° C. till converted at a pressure of more than three atmospheres.

763,478. Gustave Gin, Paris, France. **Copper sulphate.** A mixture of roasted copper ore or cementation copper is boiled with a mixture of copper sulphate, ferrous and ferric sulphate till the iron oxides are precipitated at or above 160° C. and the solution is then filtered and the copper sulphate crystallized out.

763,479. As above for **aluminum.** Aluminum fluoride 1 molecule, sodium sulphide 3 molecules, are mixed and decomposed by an electric current. Bauxite and a solution of hydrofluoric acid will, on electrolysis, give the above mixture as an intermediate product, the end-product being aluminum.

763,481. Oliver D. Goodell, Baltimore, Md. **Insecticide.** A mixture of barium sulphide 75, silicates of barium 2, and of

potassium 1, and oxides of barium and of potassium 3 each, silex 3, and carbon 10, may be used, with water or dry.

763,491. Hermann von Keler, Leverkusen, near Cologne, Germany. Assignor to Elberfeld Co., New York, N. Y. **Nitrous anhydride and nitrites.** Nickel-ammonium chloride is dissolved in sodium chloride solution and heated to expel the ammonia and precipitate the nickel hydroxide; the nickel remaining in the solution is thrown down by an alkali, and the ammonia recovered by the addition of calcium hydroxide and distillation.

763,151-2. Georg D. Burton, Boston, Mass. **Extracting essential oil.** Process and apparatus. A closed vessel contains an aqueous extracting fluid and the vegetable matter from which the extract is to be made, the vessel and contents are heated by an electric current to distil the oil, which is condensed.

763,193. Ernst Mathe, Hochst-on-Main, Germany. Assignor to Meister, Lucius und Bruning, same place. **Blue sulphur dye.** Di-*p*-hydroxyphenyl-*p*-*p*-diamino diphenylamine is heated to 100° to 120° C. with sulphur and sodium sulphide, and the dye precipitated from a water solution as a dark blue powder of metallic luster, soluble in dilute alkali blue, in concentrated sulphuric acid green, and dyeing from sodium sulphide solution a fast blue.

763,196. Robert Miegel, East Orange, N. J. **Ornamenting the edges of books.** After cutting and smoothing the edges, a body color of acid green is applied, dried, and a solution of chloride of lime in acetic acid applied.

763,233. Heinrich Weltz, Ludwigshafen-on-Rhine, Germany. Assignor to Badische Anilin und Soda Fabrik, same place. **Anthracene dye.** A polyhydroxyanthraquinone sulphonic acid and ammonia are condensed together by heat. Soluble in hot water, reddish violet, which caustic soda turns violet, becoming light red on the addition of sodium carbonate, dissolving blood-red in hot aniline.

763,260. Arthur E. Cattermole, Highgate, London, England. Separation of **metals from their gangue.** Powdered ore, water, and a water emulsion of oil are agitated together and the whole classified by an up-current jig.

763,266. Charles F. Cross, London, England. Assignor to Daniel C. Spruane, Philadelphia, Pa. Purifying **viscose.** A solution of sodium bicarbonate is added, the precipitate washed with mixed sodium bicarbonate and sodium sulphite in water. The precipitate is dissolved in caustic alkali.

763,267. John T. Davis, San Francisco, Cal. **Artificial fuel.** A mixture of petroleum and carbon is gradually heated to distil the lighter oils and leave the heavy portions of the petroleum bound with the coal dust. A mixture of ammonia with excess of

oxygen is passed over the oxide of a heavy metal at above 650° C., and lower than 750° C., the nitrous anhydride thus obtained being allowed to act on alkali bases, etc.

763,574. Raymond Vidal, Paris, France. **Iron pigments.** Nitrated aromatic compounds are treated with a mixture of iron filings and ferric sulphate, filtered, heated just below calcination of the iron salts and the impalpable powder is cooled.

763,616. Geo. M. Lawton, Worcester, Mass. **Mordant.** Gluten, cream of tartar, or tartaric acid, sodium bichromate, bicarbonate, and nitrate, pyroligneous acid, nitrate of iron, and sulphuric acid. No proportions given.

763,665. Charles M. Hall, Niagara Falls, N. Y. **Explosive.** A finely powdered brittle alloy of aluminum 60, iron 30, silicon 7, carbon 2, titanium 1, and ammonium nitrate enough to furnish oxygen to form oxides and give nitrogen in excess.

763,666. **As above** for oxidizable silicon and an oxidizing agent.

763,675. Wassily Kirssanoff, Taganrog, Russia. Assignor to Société en Actions, "Promethee," Director Metchislaw, Fiedler, Moscow, Russia. **Explosive.** Potassium chlorate 70, potassium permanganate 20, turpentine 9, and carbolic acid 1 per cent.

763,685. Mark W. Marsden, Philadelphia, Pa. **Cement.** Lime and coal ashes are mixed, powdered, calcined and again powdered.

763,746. Andrew L. Ginter, Newark, N. J. **Cement.** Prince metallic 500, japan 50, white lead 100, varnish and oil of citronella 20 each, coal tar 80, naphtha 8, and fish oil 30, thickened with ground slate.

763,756. Benno Homolka, Frankfort-on-Main, and Josef Erber, Hochst-on-Main, Germany. Assignors to Meister, Lucius und Bruning, Hochst-on-Main, Germany. **Reaction of formaldehyde on nitramines.** Aqueous solutions of nitramines are treated with formaldehyde, producing a yellow crystalline powder melting at 230° C. Insoluble in water, but soluble in hot glacial acetic acid.

763,761. Karl Jedlicka and Arnold Schedler, Basle, Switzerland. Assignors to Society of Chemical Industry, same place. **Orange tetrazo dye.** A tetrazo derivative of an azoxyamine, 1 molecule is united with 2 molecules of phenolic bodies, one being a sulpho derivative of 2,5-aminonaphthol. When the dye is diazotized on the fiber and developed with $\beta$-naphthol, Bordeaux-red shades result.

WM. H. SEAMAN.

# REVIEW OF AMERICAN CHEMICAL RESEARCH.

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## GENERAL AND PHYSICAL CHEMISTRY.

**The Dissociation of Lead Nitrate.** BY J. LIVINGSTON R. MORGAN. *J. Phys. Chem.*, 8, 416–420.—The author applies the law of mass-action to the results of Baekeland on the dissociation pressure of lead nitrate (this Journal, 26, 391). Since the gaseous products from the lead nitrate are $2NO_2 + \frac{1}{2}O_2$, the equation $(p_1)^2(p_2)^{\frac{1}{2}} = \text{const.}$ should hold true, where $p_1$ and $p_2$ are the partial pressures of the nitrogen peroxide and oxygen respectively. This is shown by the author to be approximately the case in the presence of an excess of nitrogen peroxide, but not in that of an excess of oxygen. The author suggests that the latter fact may be due to a change in the composition of the solid phase, a basic salt being produced by the expulsion of a portion of the $N_2O_5$, but, in fact, as Baekeland has proved, a basic salt is in all cases in equilibrium with the neutral nitrate and the gaseous products, and there is no conceivable reason why an excess of oxygen should change the composition of this. The van't Hoff equation of temperature-effect is also applied to the results, and by it the heat of dissociation of lead nitrate is calculated, and compared with the thermochemical data of others. The author has, however, again overlooked the fact that the solid phases involved are not lead nitrate and lead oxide, but lead nitrate and a basic lead nitrate, so that the heat-effect calculated by the van't Hoff equation must correspond to the decomposition of the neutral into the basic nitrate, and not into lead oxide. A. A. NOYES.

**The Electrical Conductivity of Very Dilute Hydrochloric and Nitric Acid Solutions.** BY H. M. GOODWIN AND R. HASKELL. *Proc. Am. Acad.*, 40, 399–415; *Phys. Rev.*, 19, 369–386.—In this article have been described measurements of the

electrical conductivity at 18° of very dilute (0.0001 to 0.002 normal) hydrochloric and nitric acid solutions made by adding to a known weight of water successive portions of 0.01 normal acid. To eliminate the effect of the impurities of the water, two methods of computation of the equivalent conductivity have been used. In both of these, the assumption is involved that the total effect of the acid and impurities on the conductance of each other is produced when a relatively small quantity of acid has been added to the water. The experiments themselves furnish evidence of the correctness of this assumption. In the first method, the increase of the specific conductance over this initial value divided by the increase of concentration is regarded as the equivalent conductivity at the higher concentration. In the second method, such a quantity, constant at every concentration, is added to the observed values of the specific conductance as will cause the maximum in the equivalent conductivity values calculated therefrom to occur at the lowest concentration at which the total influence of the acid and impurities on each other has been produced. In spite of considerable variations in the observed conductivities due to the use of different samples of water, the values of the equivalent conductivity derived from different experiments and computed by the two methods agree well with each other. New determinations were also made at higher concentrations with hydrochloric acid. The final values of the equivalent conductivity ($\Lambda$) at various round concentrations in equivalents per liter are as follows:

| Concentration. | $\Lambda_{HCl}$. | $\Lambda_{HNO_3}$. | Concentration. | $\Lambda_{HCl}$. |
|---|---|---|---|---|
| 0 | 380.1 | 377.0 | 0.005 | 372.6 |
| 0.00025 | 377.6 | 374.5 | 0.010 | 369.3 |
| 0.00050 | 377.0 | 373.9 | 0.020 | 365.5 |
| 0.00075 | 376.2 | 373.3 | 0.030 | 362.5 |
| 0.00100 | 375.9 | 372.9 | 0.050 | 358.4 |
| 0.00150 | 375.6 | ...... | 0.100 | 351.4 |
| 0.00200 | 375.3 | ...... | ...... | ...... |

The values for zero concentration or infinite dilution are extrapolated from those for 0.00025 normal under the assumption that the change between these two limits of concentration stands in the same ratio to that between 0.00025 and 0.01 normal as in the case of neutral salts, this ratio having been already derived by Kohlrausch. These values are less than one per cent. lower than those of Kohlrausch and are believed to be substantially correct. That derived by Noyes and Sammet (this Journal, **24**, 967) from transference experiments for hydrochloric acid (395.5), on the other hand, is, for some reason as yet unknown, 4 per cent. higher. H. M. GOODWIN.

**The Nephelometer, an Instrument for the Detecting and Estimating of Opalescent Precipitates.** BY THEODORE WILLIAM RICHARDS AND ROGER CLARK WELLS. *Am. Chem. J.*,

31, 235–243.—The authors give a detailed description of an improved form of the nephelometer previously described by Richards. The essential change in the apparatus consists in introducing into the field of view, by means of an adjustable system of two thin 15° prisms, two adjacent semi-circular images separated from each other by a line, whereby the ease and certainty of the observation is considerably increased. The communicated experiments, which were made with known quantities of silver chloride in three pairs of tubes, show that the constant error is no greater than one per cent. It is also proved by experiments that a very small quantity of silver chloride (1-2 mg.) can be determined by comparison with a turbid liquid containing a known quantity of silver chloride, if the precipitates are produced under the same conditions, and if, with the help of a preliminary approximate measurement, solutions of nearly the same turbidity are made up and compared. W. BÖTTGER.

**Molecular Lowering of the Freezing-point of Water Produced by Concentrated Solutions of Certain Electrolytes.** BY HARRY C. JONES AND FREDERICK H. GETMAN. *Ztschr. phys. Chem.*, **46**, 244–286; *Phys. Rev.*, **18**, 146–183. **On the Nature of Concentrated Solutions of Electrolytes.** *Am. Chem. J.*, **31**, 303–359. **On the Existence of Hydrates in Concentrated Aqueous Solutions.** *Ztschr. phys. Chem.*, **49**, 385–455.—The authors give in these three papers a report on the results of experiments, with sixty-eight electrolytes, concerning the form of the molecular freezing-point-lowering-concentration curve, the conductivity-dilution curve (at 0°) and the refraction-concentration curve, and finally on the specific gravities of the solutions investigated. The graphical representations show that the conductivity increases regularly with the dilution as was to be expected, while the molecular freezing-point lowering first decreases (down to 0.1-0.2 normal) according to the decrease of dissociation and then increases to a value several times as great as that which would be expected. The refraction increases nearly proportionally to the concentration. The increase of the molecular freezing-point-lowering above the normal value is for salts of similar composition, the more considerable the more the salt is hygroscopic or, in the case of a hydrate, the more water it contains and the more stable it is. A large number of anhydrous salts do not show such a high molecular lowering as the corresponding salts with water of crystallization. The increase above the normal value is, therefore, brought into relation with the combination of the solute with water. A further argument for this view is the fact that the boiling-point-raising-concentration curve also shows a minimum. This, however, corresponds to a higher concentration than the minimum in the freezing-point lowering-curve in accordance with the fact that the stability of hydrates is usually less at higher tem-

peratures. The different behavior of salts which are anhydrous and hydrated in the solid state indicates that the salts of both types are hydrated in solution, with this difference, however, that the hydrates of salts crystallizing without water are less complex than the hydrates of salts crystallizing with it.

The number of molecules of water combined with one mol of the solute is calculated in the following manner: The conductivity data give the degree of dissociation and with this value the theoretical molecular lowering is derived in the usual way. By combination of this value with the observed lowering, the amount of water acting as solvent in this solution can be obtained and the difference between 1000 and this number is the quantity of water combined with the salt. This value, divided by 18, gives the number of mols of water combined.

The behavior of the different salts is illustrated by curves which represent either the total number of mols of water combined with the solute in one liter or the number of mols of water combined with one mol of salt as a function of the concentration. The curves of the first type show a regular increase with increase of concentration. The other curves have a rather irregular form and show a maximum value for the number of combined mols of water at the concentration 0.2-0.6 normal. There exists, therefore, a concentration at which there is more water combined than at any lower or higher concentration. From this result the authors conclude (in the third paper) that not only the undissociated molecules, as was assumed in the second paper, but also the ions take up water.

However in the opinion of the reviewer, these conclusions seem to be unwarranted, because they are in contradiction with the mass-action law, which requires the greatest hydration in the most dilute solutions. This fact seems to indicate that the errors involved in the calculations are more considerable than is assumed by the authors. This view is strengthened by the fact that magnesium chloride and bromide exhibit not only very marked differences in the amount of hydration but also that these differences vary considerably within a small interval of concentration. The possible interpretation that this might be due to the different anions is contradicted by the form of the curves for calcium chloride and bromide. And there is another *theoretical* and, therefore, perhaps more important objection to be made. The calculations are based upon the assumption that the deviation of the substances considered from the law of Raoult is to be ascribed *completely* to the formation of hydrates and not in any degree to the inapplicability of that law for physical reasons, to such concentrated solutions. Taking into account the great improbability of this assumption one is led to the conclusion that the numerical statements regarding the formation of hydrates in solution are

still too uncertain to warrant building further conclusions upon them.

Finally, it may be mentioned that the authors describe in the third paper, also, a number of experiments with some non-conductors. Glycerol, for instance, shows a marked hydration and from the numbers for cane-sugar it is concluded that it takes up in the interval of 0.4 to 2 normal, nearly the same number of molecules of water as does sodium chloride. W. BÖTTGER.

**The Action of a Solution of Dry Hydrochloric Acid in Benzene on Dry Zinc.** By K. G. FALK and C. E. WATERS, *Am. Chem. J.*, **31**, 398–410.—Each of the authors has investigated separately this reaction, which had been previously studied by Kahlenberg (this Journal, **24**, R. 273), for they assumed that by this investigator, moisture was not eliminated to a sufficient extent. From the experiments of Falk it follows that zinc dissolves only very slowly in a benzene solution of hydrochloric acid, so that the quantity of gas evolved can be determined only after a considerable time. The zinc is then covered with a layer of chloride which plainly retards greatly the further action of the hydrochloric acid. The action appears to cease sooner, when the protecting layer of chloride forms more quickly, as it does in the presence of a little water. Waters in his experiments has especially taken into consideration the circumstance overlooked by Falk that in heating the zinc to remove the moisture, oxide is formed. The result of various experiments was that zinc heated in a current of carefully dried hydrogen dissolves more quickly than that used in the preceding experiments. The action was ended after an hour; the surface of the zinc had then become somewhat darker, but the white layer, observed by Patten, could not be seen upon it. The details of the experiment cannot be here described. W. BÖTTGER.

**A Study of Hydrolysis by Conductivity Methods.** By JULIUS STIEGLITZ AND IRA H. DERBY, *Am. Chem. J.*, **31**, 449–458.—The purpose of this investigation was to decide what values of the molecular conductivity of hydrochloric acid gave the most correct value of the degree of hydrolysis of hydrochlorides, when calculated with the help of the Mass Action Law Equation given by Walker (*Ztschr. phys. Chem.*, **4**, 319). Experiments were made with $^1/_{32}$ normal hydrochloric acid and $^1/_{32}$ normal potassium chloride which were mixed in different proportions. It was found that the calculated content in hydrochloric acid agreed best with that actually used when the value of the conductivity of hydrochloric acid corresponding to the total content in electrolyte was made the basis of the calculation. The deviations are, as was to be expected, smaller for large concentrations of the acids than for smaller ones. Furthermore,

there are communicated the results of experiments in which a solution of $^1/_{32}$ normal hydrochloric acid and potassium chloride was diluted in one case with a $^1/_{32}$ normal potassium chloride, and in the other case with a $^1/_{32}$ normal hydrochloric acid. Finally, mixtures of aniline with large or small excesses of hydrochloric acid were analyzed in the same way. In this case the values found agreed very satisfactorily with those which were calculated with the help of the hydrolysis-constant of the aniline hydrochloride. This investigation is to form a basis for the determination of the composition of solutions whose composition is changing rapidly with the formation of acid (see the following abstract), also for the determination of the affinity-constant of unstable, weak bases. W. BÖTTGER.

**The Molecular Transposition of Aminophenylalkylcarbonates.** By JULIUS STIEGLITZ AND HENRY T. UPSON. *Am. Chem. J.*, 31, 458–502.—In this article a problem of organic chemistry is treated with the help of physico-chemical methods. *o*-Aminophenylalkylcarbonate ($NH_2.C_6H_4.O.CO_2.C_2H_5$) transposes spontaneously into *o*-phenyl urethane ($C_2H_5.O.CO.N.C_6H_4.OH$). Moreover, the same transposition takes place with the salts like the hydrochlorides. The question to be answered is whether the salt is directly (1) transposed:

$$RO_2.CO.C_6H_4.NH_3Cl \rightarrow HO.C_6H_4.NH.CO_2R + HCl$$

or whether the transposition takes place indirectly through the base (2) formed by hydrolysis:

$$RO_2.CO.C_6H_4.NH_3OH \rightarrow HO.C_6H_4.NH.CO_2R + H_2O.$$

The decision between these two possibilities was reached by the determination of the velocity constant. The interesting experimental details of the method used for determining the composition of the solution through experiments of its conductivity cannot be here described. Of the results of the experiments it is to be mentioned that the constants corresponding to the first assumption show a pronounced progression, while those corresponding to the second assumption agree very satisfactorily throughout the range of 20-90 per cent. transposition. Thus a decision is reached in favor of the second hypothesis. The numerical values are summarized in the following table:

| | | Hydrolysis constant. | Affinity constant of base $\times 10^{14}$. | Velocity constant. |
|---|---|---|---|---|
| I. | 4-aminophenylmethylcarbonate .... | 23200 | 2700 | .... |
| II. | 4-aminophenylethylcarbonate ...... | 22050 | 2650 | .... |
| III. | 2-aminophenylmethylcarbonate .... | 1040 | 125 | 0.1017 |
| IV. | 2-aminophenylethylcarbonate ...... | 800 | 96 | 0.0578 |
| V. | 4-methyl-2-aminophenylethylcarbonate | 1020 | 122.5 | 0.0186 |
| VI. | 5 methyl-2-aminophenylethylcarbonate | 1800 | 216 | 0.0717 |
| VII. | 6-methyl-2-aminophenylethylcarbonate | 880 | 105 | 0.0659 |

These values all refer to 0°. As the authors in deriving the

values of the affinity constant of the base used the value of the dissociation constant of water at 25°, which is about ten times as great as that at 0°, the values given by them are ten times too large. To those given in the table above, the correction for this error has, however, been applied.

It will be seen from the table that the change of the affinity constant of the base and that of the velocity constant are by no means parallel. The velocity constant is influenced in a much more pronounced degree by the change in the composition of the molecule.

In the second part of the article, the authors report upon experiments which are devoted to a fuller determination of these constitutive influences. As the making of the measurements, in consequence of the slight solubility of the compounds, proved to be very difficult, those made thus far have only a qualitative character. It is evident that especially the replacing of hydrogen by halogen in position 6 greatly increases the velocity of the reaction. The introduction of chlorine into position 4 retards the reaction, as does also the replacement of H by $CH_3$.

W. BÖTTGER.

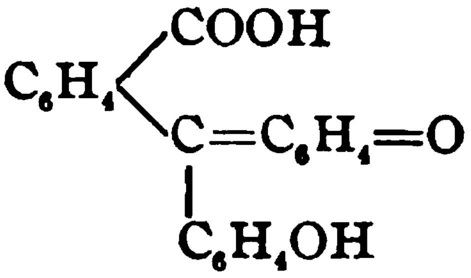
**On the Ionization Constants of Phenolphthalein and the Use of This Body as an Indicator.** BY H. N. MCCOY. *Am. Chem. J.*, 31, 503–521.—As can be seen from the title, the author aims to explain the state of dissociation of phenolphthalein. For this purpose the constant of hydrolysis of the ammonium salt of the phenolphthalein was first determined by comparing the color of solutions which contained definite concentrations of ammonium hydroxide and chloride (hence, known concentrations of OH′) and of phenolphthalein with the color of known concentrations of the sodium salt. By application of an excess of $^1/_{100}$ normal sodium hydroxide the hydrolysis of the sodium salt was so far reduced (to 1.6 per cent.) that it could be neglected. On account of the minute concentration of the indicator, which could be employed, the accuracy of the results is not very high. The mean value adopted is $1.6 \times 10^{-4}$. From this value and from the dissociation-constant of water the dissociation-constant of the phenolphthalein is calculated to be $7.5 \times 10^{-11}$.

From the results, above mentioned, the conclusion is derived, that a solution containing $^1/_{20000}$ mol. of phenolphthalein per liter must contain at least $10^{-6}$ mol. of OH′, in order to give just a perceptible reddish color, and it is demonstrated that the part of an acid which is not neutralized by the titration, is defined by the expression: $E_a = \frac{1.2 \times 10^{-8}}{K_A}$, where $K_A$ is the dissociation constant of the acid. Thus it is seen, that acids, which have a dissociation-constant of $1.2 \times 10^{-5}$ or $0.6 \times 10^{-5}$ can be measured with an error of 0.1 or 0.2 per cent., if the volume is 100 cc. In the same

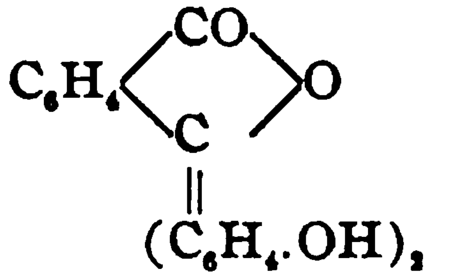
manner it is shown that bases must have a dissociation constant of $10^{-3}$ or $0.5 \times 10^{-3}$ if they are to be titrated under the same conditions with the same accuracy. The further conclusion is derived from the above-mentioned determinations that a $^1/_{10}$ normal solution of sodium acetate should at the ordinary temperature be so much hydrolyzed that a $^1/_{30000}$ normal solution of phenolphthalein would be just turned red by it, and this is experimentally confirmed.

The second part of the investigation deals with the disappearance of the red color upon the addition of a great excess of an alkali. This is ascribed by the author to the behavior of the red salt as a weak acid. The ratio of the concentrations of the chinoid form I, to which the red salt corresponds, and of the lactone II in a water solution of phenolphthalein is approximately $10^{-6}$. For the colorless salt the structure III is assumed:

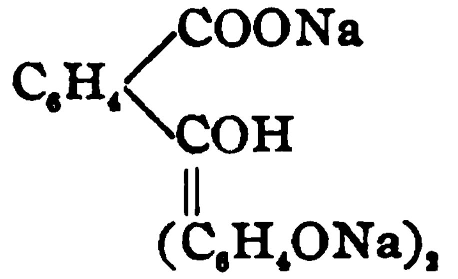
I.



II.



III.



The hydrolysis constant of the colorless alkaline solution is found to be $8 \times 10^{-3}$, from which value the dissociation constant of the red salt (behaving as a weak acid) is calculated to be $1.5 \times 10^{-12}$. The transformation constant, or the ratio of colorless salt to red salt (pseudo acid) is approximately $10^{-2}$. With regard to the transformation it may be mentioned that the rate of the process can be easily followed. W. BÖTTGER.

**The Hydrolysis of Ethylbutyrate by Lipase.** BY J. H. KASTLE, MARIUS EARLY JOHNSTON, AND ELIAS ELVOVE. *Am. Chem. J.*, **31**, 521–550.—In the first place it is shown that a clear, yellowish solution of lipase is obtained, if an extract of fresh hog liver is treated with a small volume of $^1/_{100}$ normal solution of hydrochloric acid. After a short time a precipitate results, which may readily be filtered off. Instead of hydrochloric acid, butyric acid can also be used with equally good results. However, the clear filtrate saponifies only half as quickly as an extract which has not been treated with acid. Of the experiments made with the clear liquid the following seem to be of most interest. A solution of lipase will saponify a quantity of ethylbutyrate at least sixty times as great as its own weight. This ratio is rather too low, however, for it was assumed that the residue of evaporation from the lipase solution is pure lipase. The stability of a weakly acidulated solution is considerable; after five months the decrease of saponifying power was only 7.0 per cent. By repeated filtration the concentration of the solution of lipase is not appreciably

changed but by a Pasteur-Chamberland filter the enzyme is completely retained.

From the experiments upon the rate of decomposition of the ethylbutyrate the authors conclude that the reaction is a monomolecular one. However, it is to be noted that the law of a reaction of the first order holds only approximately for this reaction for a decided decrease (for instance, in one case from 0.00538 to 0.00352) of the velocity constant is noticeable.

While the experiments at higher temperatures indicate a better agreement with the law it is to be noted that in this case the investigation was extended over a much smaller variation of concentration. Also the explanation given for the retardation that this is due to the inhibiting action of the acid produced during the hydrolysis does not seem to be warranted by the experiments given. According to the method of van't Hoff for the determination of the number of molecules involved in a reaction the authors found the values, 0.99 and 0.97, thus confirming his conclusion that it is a monomolecular one. The ratio of the constants corresponding to two temperatures differing by 10° was found to be 1.69 between 0° and 40°.

The result that lipase is not changed by exerting its hydrolytic activity was also confirmed by quantitative experiments. Thus a certain quantity of lipase can saponify any quantity of ester if the acid formed during the process is neutralized from time to time. For this reason the authors consider the lipase as real catalyzer.

The authors also endeavor to show that the rate of the hydrolysis is independent of the concentration of the butyrate. They report, moreover, comparative experiments on the hydrolytic action of lipase, hydrochloric acid and sodium hydroxide. These show that the solution of lipase used is more effective than $^1/_{150}$ normal sodium hydroxide, and essentially more active than $^1/_{150}$ hydrochloric acid. If one might see in this, a support for the view that these observations constitute an argument for the basic character of lipase, this would contradict the conclusion concerning the order of this reaction, for the action of sodium hydroxide upon esters is not a *catalytic* one, but a reaction of the *second* order. Also, it seems to the reviewer that the conclusion that the rate of hydrolysis is independent of the concentration of ethylbutyrate might not be compatible with the above-mentioned view concerning the order of the reaction and the activity of the lipase, for if it is assumed to be true that the action of lipase is a catalytic one, then the rate of the *monomolecular* reaction should yet be proportional to the concentration of any substance which undergoes an appreciable decrease of concentration, *i. e.*, to the concentration of the ethyl butyrate. W. BÖTTGER.

**The Significance of the Maximum in the Conductivity Curves of Kraus at High Temperatures.** BY HARRY C. JONES. *Am. Chem. J.*, 31, 584–585.—The author discusses the existence of a maximum in the conductivity-temperature curve below the critical point of the solvent and insists upon the interest which attaches to it as representing the point at which the increase in migration-velocity is just compensated by the decrease in ionization. This has, however, been recognized by many previous investigators.

W. BÖTTGER.

**The Toxic Action of Acids and Salts on Seedlings.** BY FRANK K. CAMERON AND J. F. BREAZEALE. *J. Phys. Chem.*, 8, 1–13.—The experiments have been made with seedlings of *Triticum vulgaris*, *Zea mais* and *Trifolium prateusea*. The substances used are sulphuric, hydrochloric, nitric, acetic, oxalic, succinic and malic acids and the corresponding potassium salts, also potassium carbonate and the chloride, nitrate, and acetate of calcium. The results show that the behavior is more complicated than would correspond to the view that it is exclusively an effect of the corresponding ions. The authors, however, point out rightly that this does not constitute any objection to the ionic theory. The interpretation of the behavior of mixtures of acids and salts is still more difficult.

W. BÖTTGER.

**On the Dielectric Constants of Solvents and Solutions.** BY HAROLD EVERETT EGGERS. *J. Phys. Chem.*, 8, 14–36.—The author has determined the dielectric constants of the following substances by the method of Drude. The temperatures at which the experiments were carried out are added in parenthesis:—Methylsulphocyanate, 33.3 (15.5°); ethylsulphocyanate, 31.2 (11.5°); amylsulphocyanate, 17.1 (19.5°); methyl mustard oil, 17.9 (40.0°); ethyl mustard oil, 22.0 (15.0°); allyl mustard oil, 17.3 (17.6°); phenyl mustard oil, 8.5 (11.6°); amylsulfhydrate, 4.9 (18.0°); phenyl isocyanate, 3.36 (17.0°); thiophene, 2.85 (13.0°); ethyldisulphide, 15.6 (19.0°); thioacetic acid, 17.3 (21.0°); acetyl acetone, 25.7 (18.0°); acetylmethylhexylketone, 27.4 (19.0°); malonic nitrile, 46.3 (32.6°); pinacoline, 12.6 (17.5°); nitranisol, 23.8 (19.8°). It is estimated that the results are accurate to 3 per cent.

As to the influence of the relative chemical structure of the molecule upon this property, which is discussed in relation to the results previously obtained with the nitriles (this *Rev.*, 7, 115), it may be mentioned that a cyanogen radical at the end of a chain increases very markedly the dielectric constant; two cyanogen radicals diminish mutually this effect, and in a more pronounced degree, the closer they are together. This fact is well illustrated by the series, cyanogen (2.52), malonic nitrile (46.3), and ethylene cyanide (61.2). However, the increase observed is the resultant of two influences of an increase produced by the increase

of the distance between the two cyanogen radicals and of a decrease produced by the increase in the size of the molecule.

The author also investigated some mixtures, thus solutions of sulphur in carbon disulphide, phosphorus in carbon disulphide, menthol in carbon disulphide, benzene, acetonitrile and camphor in benzene and carbon disulphide. The results show that the figures observed do not agree with the value calculated by the rule of mixtures from the volume percentage, according to the formula advanced by Silberstein. From the fact that one substance when dissolved in several solvents does not exert a similar influence on the dielectric constant of the mixture the author concludes that this is due to the formation of a compound with the solvent in variable proportions. There is, however, no experimental justification whatever for such a radical change in the prevailing views in regard to chemical combination.

W. BÖTTGER.

**The Resistance of Glass Tubing to Bursting Pressure.** By W. P. BRADLEY AND A. W. BROWNE. *J. Phys. Chem.* 8, 36–54.—This investigation is a valuable contribution to the question, equally important for science and industry, of the relation between bursting pressure ($p$), internal diameter ($b$) and thickness of wall ($w$). For seven different sorts of glass (for a number of samples of each sort), the value of $pb/w$ has been determined. The results obtained are illustrated by the following table, which shows the resistance of the different sorts of glass and gives an idea of the amount of deviation in the behavior of the separate samples from the mean value of the expression $pb/w$.

| Glass. | Average $p.\frac{b}{w}$ Atm. | Average percentage variation. | Maximum percentage variation. | Number of tubes tested. |
|---|---|---|---|---|
| Bohemian | 627 | 15.3 | +25.2 | 6 |
| Jena | 1213 | 19.5 | +60.6 | 11 |
| Greiner and Friedrichs | 1057 | 32.7 | −61.3 | 7 |
| Gundelach | 1215 | 51.1 | +94.6 | 11 |
| American | 1270 | 7.2 | −14.7 | 6 |
| Whitall Tatum Co. | 851 | 11.3 | +28.9 | 23 |

The paper also contains many useful remarks about the fastening of glass tubes in the Cailletet apparatus.

W. BÖTTGER.

**Thermometric Analysis of Solid Phases.** BY E. S. SHEPHERD. *J. Phys. Chem.*, 8, 92–115.—In this paper there is described an application of the method devised by Bancroft (this *Rev.*, 8, 440) to experiments of Heycock and Neville (*J. Chem. Soc.*, 59, 936) with mixtures of gold, cadmium, and zinc. By taking into account a later paper of the same author (*J. Chem. Soc.*, 65, 65) it is shown that there is not only formed the compound AuCd, but also the compound $AuCd_3$. At the end of his

paper the author points out that this method seems to be the only one by which the constitution of alloys of the more volatile elements and also of the amalgams of the high-melting metals can be ascertained. In these cases the freezing-point curve cannot be determined. W. BÖTTGER.

**A Reaction whose Rate is Diminished by Raising the Temperature.** BY CLARA C. BENSON. *J. Phys. Chem.*, 8, 116–121. —The reaction in question is the formation of iodine in mixtures containing chromic acid, potassium iodide, and ferrous sulphate. The figures given do not show whether this phenomenon is related to the decrease of dissociation of the ion $FeI^{\cdot}$ (*J. Phys. Chem.*, 7, 239) with increase of temperature or to an increase of the reaction of the peroxide with the residual ferrous salt. The ratio of the velocities at 0° and 30.2° increases with increasing concentration of the acid. W. BÖTTGER.

**The Dielectric Constants of Some Inorganic Solvents.** By HERMAN SCHLUNDT. *J. Phys. Chem.*, 8, 122–130. The author has, in continuation of his previous work, determined the constants of the following substances by Drude's method.

| Formula | Di E. C. | Temp. | Spec. conduct. |
|---|---|---|---|
| $PCl_3$ | 3.72 | 18 | ...... |
| $PBr_3$ | 3.88 | 20 | $<1 \times 10^{-6}$ |
| $PI_3$ | 4.12 | 65 | ...... |
| $PI_3$ solid | 3.66 | 20 | ...... |
| $AsCl_3$ | 12.6 | 17 | $3.8 \times 10^{-6}$ |
| $AsCl_3$ solid | 3.6 | —50 | ...... |
| $AsBr_3$ | 8.83 | 35 | $<2 \times 10^{-6}$ |
| $AsBr_3$ solid | 3.33 | 20 | ...... |
| $AsI_3$ | 7.0 | 150 | $3.1 \times 10^{-6}$ |
| $AsI_3$ solid | 5.38 | 18 | ...... |
| $SbBr_3$ | 20.9 | 100 | $5 \times 10^{-5}$ |
| $SbBr_3$ solid | 5.05 | 20 | ...... |
| $SbI_3$ | 13.9 | 175 | $1.1 \times 10^{-4}$ |
| $SbI_3$ solid | 9.1 | 20 | ...... |
| $P_4$ liquid | 3.85 | 45 | ...... |
| $P_4$ liquid | 3.85 | 20 | ...... |
| $P_4$ solid | 4.10 | 20 | ...... |
| $SiCl_4$ | 2.40 | 16 | ...... |
| $N_2O_4$ | 2.56 | 15 | ...... |
| $N_2O_4$ solid | 2.6 | —40 | ...... |

This table shows that the value for the dielectric constant of the compounds in the solid state is less than the value in the liquid state and it seems that this is connected with the molecular rearrangement occurring with the solidification of the substance. Amorphous substances show as a rule no marked change in the value of the dielectric constant upon liquefying. The behavior of the above-mentioned substances corresponds in general to the Nernst-Thomson rule. The author incidentally calls attention to the fact that tubes of uranium glass and tubes

containing fluorescent solutions were specially sensitive to electric oscillations. W. BÖTTGER.

**A Construction for Direct-reading Scales for the Slide Wire Bridge.** BY EDGAR BUCKINGHAM. *Phys. Rev.*, 17, 382–383.—Since it is often convenient to have the scale of the slide wire bridge so divided as to read directly the ratio of the bridge arms, the author gives the following graphical construction for carrying out such a division. The method consists in laying off a parallelogram one meter on a side with angles of 60° and 120°, and drawing the shorter diagonal. If, then, a meter scale be laid along one side with its zero point coinciding with a corner at one of the obtuse angles, and lines be drawn from the division marks of the scale to the corner of the acute angle opposite, these lines will intersect the shorter diagonal in points which divide that diagonal into parts, the ratio of whose lengths is equal to the ratio of the corresponding scale readings divided by the total number of scale divisions in one side of the parallelogram. Thus, if the line be drawn from the 23 cm. mark of the scale, the diagonal will be divided into parts, the ratio of whose lengths is $\frac{23}{100} = 0.23$. It is evident that any line included between two sides of the parallelogram or the production of these sides and parallel to the shorter diagonal, will be divided in the same ratio as the diagonal.
C. A. KRAUS.

**Secondary Radioactivity in the Electrolysis of Thorium Nitrate.** BY GEORGE C. PEGRAM. *Phys. Rev.*, 17, 424–440.—With an impure specimen of thorium nitrate a deposit of lead oxide was obtained at the anode. This deposit was found to be radioactive, the radiations being mainly of the $\alpha$-type. The activity decreases to one-half its value in eleven hours. No visible deposit was obtained with pure thorium nitrate, although the anode became radioactive, the rate of decay of the activity in this case being very high. The gases evolved in the electrolysis of thorium solutions and substances precipitated from such solution either electrolytically or chemically all acquire radioactivity, but in all cases the radioactivity decays more rapidly than with the lead oxide from the impure thorium. The author concludes that substances separated from thorium nitrate solution acquire radioactivity, the rate of decay of which depends on the method of separation. C. A. KRAUS.

**On the Theory of the Electrolytic Rectifier.** BY S. R. COOK. *Phys. Rev.*, 18, 23–39.—Following up the idea that the high resistance of an aluminium anode is due to a counter electromotive force as was shown by Tait, the author measures the current and counter electromotive force of a carbon-aluminium plate rectifier for different values of applied electromotive force. The measure-

ments were carried out with a potassium aluminium sulphate solution as electrolyte at temperatures of 1°, 23°, 48° and 58°. At the three lower temperatures as the applied electromotive force increases, the counter one increases rapidly to a maximum, after which it falls, while the current increases very slowly until the maximum counter electromotive force is reached, after which it increases rapidly. At 58°, however, the behavior is radically different. While the counter electromotive force in this case also rises to a maximum, it rises slowly at first, then more rapidly and then again slowly. The current, on the other hand, increases rapidly from the start. The counter electromotive force current curves at 48° and at 58° are so radically different from each other that it seems desirable to have the experiments resumed over the intervening interval of temperature. With a freshly scraped aluminium anode the value of the current at first approaches that of the same cell with an aluminium cathode.

While the film formed on the anode at lower potentials appears to be amorphous, when the voltage exceeds the critical value at which the counter electromotive force reaches its maximum, dark spots appear on the anode which are crystalline in structure. If the electromotive force be maintained above the critical value for some time, the crystals go into solution and new ones are formed, the anode thus being dissolved. The amorphous film appears to be insoluble. It was shown that no oxygen is liberated at the anode, nor is it present as gas. On the other hand the anode was found to increase in weight, in one case more than corresponds to the formula $Al_2O_3$. The author concludes that the oxygen combines with the anode at lower potential to form an insoluble amorphous film of high resistance. As a result an accumulation of negative ions takes place around the anode, which accounts for the high counter electromotive force. When the critical electromotive force is reached, the film crystallizes in spots breaking the non-conducting surface and allowing the ions to reach the metal. It is apparent from the above investigation that an aluminium rectifier becomes inefficient when the temperature reaches 58°. C. A. KRAUS.

**On the Determination of Refractive Indices by Means of Channeled Spectra.** BY S. R. WILLIAMS. *Phys. Rev.*, **18**, 280–295.—The author develops a photographic interference method of determining refractive indices, for the details of which the reader must be referred to the original. For accurate measurements the method recommends itself in several respects. With the exception of a single quantity, which is readily obtained by direct observation, all the data which are required in calculating the refractive indices of a substance for the visible spectrum, may be obtained from the photographs. These measurements may thus be carried out at any time, the photographs serving as a

permanent record from which the refractive indices and the dispersion of the substance may be deduced. Moreover, for any wave-lengths intermediate between the principal spectral lines, the indices are *experimentally* determined and not by interpolation as they are in the ordinary prism method. C. A. KRAUS.

**A Study of the Silver Voltameter.** BY K. E. GUTHE. *Phys. Rev.*, 19, 138–153; Bulletin of the Bureau of Standards, 1, 21.—A comparative study is made of six different types of voltameters, both as regards agreement among instruments of the same type as well as among instruments of different types. The following types of voltameters were studied:

(*1*) The usual type, consisting of a platinum bowl 10 cm. in diameter and 5 cm. deep. A silver plate surrounded by filter-paper serves as anode. The solution is 20 per cent. silver nitrate.

(*2*) *The Silver Oxide Voltameter.*—In this type the anode is surrounded by a porous cup with a layer of silver oxide in the bottom. The current is forced to pass through this layer by surrounding the sides of the cup with a glass tube. The solution is a 20 per cent. silver nitrate which has stood over silver oxide.

(*3*) *The Richards Voltameter.*—This consists of a platinum crucible 10 cm. high and 6 cm. wide as cathode with a silver rod anode surrounded by a porous cup made from the lower end of a Pasteur filter. The electrolyte, which is the same as in type 1, is kept at a lower level in the cup than in the crucible.

(*4*) *Large Silver Anode Type.*—A platinum bowl serves as cathode while the silver plate anode is surrounded by a porous cup 7 cm. in diameter with a layer of finely granulated silver on the bottom upon which the anode rests. The solution is the same as in type 1.

(*5*) *Leduc's Form.*—This differs from type 4, chiefly in that the silver granules are held to the anode by means of filter-paper and muslin.

(*6*) A modified Richards type, in which a layer of silver crystals is placed in the bottom of the porous cup while the level of the liquid within the cup is the same as outside. The bottom of the cup is surrounded by a small glass cup to prevent the current passing through the crystals.

With a deposit of about 4 grams of silver, the mean percentage differences for two instruments of the same type are as follows: Richards type, 0.004; usual type, 0.017; silver oxide type, 0.003; large anode type, 0.001. In comparing the different types the current was varied between 0.1 and 1.5 amperes. The Richards type being taken as a standard for comparison, the mean percentage differences are given below, about four grams of silver being deposited. Positive differences indicate that the given voltameter deposited the greater amount of silver. The differences are: Usual type, +0.048; silver oxide type, +0.055;

Leduc's type, +0.057; large anode type, +0.003; modified Richards type, —0.002.

As Richards has already done (this *Rev.*, **8**, 442), the author ascribes the large values of types 1 and 2 to the disturbing influence of the anode liquid when it reaches the cathode. In Leduc's type he ascribes the discrepancy to the presence of filter-paper in the solution. When the voltameter is so arranged that the anode liquid can not reach the cathode, the deposit may be made on silver as well as on platinum.

With the porous cup voltameter the author determines the electrochemical equivalent of silver to be 1.11683 mg. which gives a value of 1.11736 mg. with the filter-paper voltameter. The corresponding number of coulombs per equivalent weight of silver (107.93 grams) is 96,640 for the porous cup voltameter, or 96,590 for the usual type. C. A. KRAUS.

**The Application of Allotropic Silver for the Preparation of Conducting Fibers.** BY N. A. DUBOIS. *Phys. Rev.*, **19**, 48–50. —It is found that an alcoholic "emulsion" of allotropic silver, prepared by Lea's method (*Am. J. Sci.*, **37**, 476), lends itself to the coating of delicate fibers, which are afterwards rendered conducting by treatment with hydrogen chloride gas.

C. A. KRAUS.

**Some Physical Properties of Current Bearing Matter. I. Tensile Strength. II. Melting-point.** BY PAUL R. HEYL. *Phys. Rev.*, **19**, 281–292.—The results obtained were negative. The tensile strength is affected less than 0.5 per cent. by a current of 2000 amperes per square centimeter in iron and less than 0.2 per cent. for 1000 amperes per square centimeter in copper. The melting-point of tin is affected less than 2° by a current of 2500 amperes per square centimeter. C. A. KRAUS.

**Effect of Mechanical Vibration upon Carbon Dioxide Near the Critical Point I.** BY W. P. BRADLEY, A. W. BROWNE AND C. F. HALE. *Phys. Rev.*, **19**, 258–272.—With a Cailletet compression apparatus connected with a tube of carbon dioxide near the critical point, the authors observed the formation of "fog" in both the liquid and the vapor, when disturbed by a vertical mechanical shock. The phenomenon is ascribed to vibrations, induced in the connecting mercury column which change the volume of the carbon dioxide. By means of a vibrator whose frequency could be varied, the effect of mercury columns of different lengths was studied and, in agreement with the above explanation, it was found that with increasing length of the mercury column lower frequencies were required to produce the "fog." The effect of temperature and of the volume of fluid was also studied. A second communication is to follow.

C. A. KRAUS.

## MINERALOGICAL AND GEOLOGICAL CHEMISTRY.

**The Genesis of the Copper-Deposits of Clifton-Morenci, Arizona.** By Waldemar Lindgren. Advance Extra *Trans. A. I. M. E.*, Lake Superior Meeting, September, 1904, 40 pp.—"The geographical distribution of the copper-deposits is practically coextensive with the great porphyry stock and its dike systems. The deposits occur either in the porphyry or close to its contacts, or among dikes of porphyry in some other rock." The various probable steps in the genesis of the ores as worked out carefully by the author, cannot be here followed. Suffice it to say that they are believed to have been formed primarily by mineral-laden magmatic waters originally held in the magma under great pressure and at high temperature. These solutions acted upon the adjoining limestones and shales without preliminary concentration in pegmatitic or aplitic veins, and produced important contact metamorphism. Low-grade pyritic deposits resulted from these earlier processes, the final concentration to payable ore bodies having been effected by descending surface waters. A portion of the argument as to the origin of the earliest deposits is based on a study of the fluid inclusions in the quartz of the porphyry and of the veins. In both cases the inclusions consist of salt solutions in which appear cubical crystals of salt and grains of ferric oxide. That the temperature must have been high is proved by the fact that the mass of the separated salt crystals is in many cases far too great to have ever been held in solution by the accompanying liquid at any ordinary temperature. These solutions are supposed to have held heavy metals besides iron, also silica, which they deposited, receiving in exchange carbonic acid, when subsequent fissuring allowed them to ascend through the overlying sediments.

Forty-seven minerals are enumerated as constituting or associated with the ore deposits. Among these are the rare copper minerals spangolite, gerhardtite, atacamite and libethenite, and the new minerals coronadite and morencite (see next abstract). The valuable ores are chalcocite, chalcopyrite, malachite, azurite, chrysocolla, brochantite, cuprite and native copper. Brochantite, which is usually regarded as an uncommon species, constitutes here in some places an important ore. Being intergrown with malachite and resembling it in color, its presence had heretofore been overlooked. W. F. Hillebrand.

**Minerals from the Clifton-Morenci District, Arizona.** By W. Lindgren and W. F. Hillebrand. *Am. J. Sci.*, 17, 448–460; figures. *Coronadite.*—A new species, from the Coronado vein, three-fourths of a mile west of Horseshoe shaft. Color black, in structure delicately fibrous, cementing angular quartz grains. Not unlike psilomelane in appearance. Opaque in thin

section. Composition: $MnO_2$, 56.13; $MnO$, 6.56; $PbO$, 26.48; $ZnO$, 0.10; $CuO$, 0.05; $MoO_3$, 0.34; $Al_2O_3$, $TiO_2$, $P_2O_5$, $V_2O_5$, 0.63; $Fe_2O_3$, 1.01; $H_2O$, 1.03; Insol. and $SiO_2$, 7.22; $CaO$, $MgO$, Alk., loss, 0.45. Total, 100.00. Specific gravity of material containing 6–7 per cent. of silicious gangue, 5.246 at 22°. If the mineral is to be regarded as anhydrous, the formula $R''(Mn_3O_7)''$, in which $R'' = Pb''$ or $Mn''$, satisfies the ratio afforded by the above analytical results, but if the water is to be regarded as essential, and furthermore constitutional, the formula becomes perhaps $R''_4H_2(Mn_{11}O_{29})$. Either formula is referable to orthomanganous acid in different degrees of condensation. The difficulty of determining accurately the formulas of such compounds by reason of the known tendency of manganese to form many of the same general type, is pointed out, and also the possibility of the formation of numerous isomers. *Morencite.*—A new species, from the Arizona Central mine at Morenci. Brownish yellow, silky fibrous seams in a lime shale. The fibers are slightly pleochroic under the microscope, birefringence is strong and extinction strictly parallel to the fibers. Composition, $SiO_2$, 45.74; $TiO_2$, trace; $Al_2O_3$, 1.98; $Fe_2O_3$, 29.68; $FeO$, 0.83; $MnO$, trace; $CaO$, 1.61; $MgO$, 3.99; $K_2O$, 0.20; $Na_2O$, 0.10; $H_2O$ at 105°, 8.84; $H_2O$ at 150°, 0.12; $H_2O$ below redness, 4.27; $H_2O$ at redness, 0.69; $CuO$, little; $FeS_2$, 0.66; $P_2O_5$, 0.18. Total, 98.89. Although the mineral is well individualized the ratios lead to no satisfactory formula, chiefly because of uncertainty as to the rôle played by the water. It is considered best to regard the mineral as a hydration product of an original metasilicate molecule. Since the publication of this paper the same mineral in a somewhat less pure form has been identified among some specimens collected by Mr. Lindgren at Cripple Creek, Colorado (W. F. H.). *Libethenite.*—This occurs in the Coronado lode. The first observed occurrence of the mineral in this country. Crystallographic constants are reported by Professor Penfield. *Brochantite*, usually regarded as one of the rarer minerals is here of common occurrence, generally masked by association with malachite. *Spangolite, Gerhardtite.*—No measurable crystals of either of these rare and interesting species were found, but their identification is beyond question. The blowpipe and closed-tube reactions of both are striking. With the gerhardtite occurs a chloride, perhaps atacamite. *Copper-pitch ore.*—This is of common occurrence in some of the copper districts of Arizona. It varies in color from dark-brown to pitchy black, sometimes dull, but generally with glassy to resinous luster; hardness about 4, streak dark-brown. It has sometimes been described as impure chrysocolla, with which mineral it is often associated, but it is not chrysocolla, and its composition seems to vary widely in different districts. The Morenci material is a hydrous compound of copper (zinc) and manganese peroxide with considerable matter insoluble in acid

and a few per cent. of oxides of iron, aluminum and phosphorus. A variety from Bisbee, named by König melanochalcite, is considered by him to be a hydrous silico-carbonate of copper. *Chalcocite*, *Willemite*, *Calamine*, *Chrysocolla*, and *Dioptase* are the other species described in the paper. The crystallographical constants of the last are reported by Professor Penfield.

W. F. HILLEBRAND.

**Emmonsite (?) from a New Locality.** BY W. F. HILLEBRAND. *Am. J. Sci.*, 17, 433–434.—Collected by Messrs. Lindgren and Ransome in the W. P. H. mine at Cripple Creek, Colorado. Differs from the original emmonsite in assuming mammillary forms instead of crystalline plates. Optical properties, so far as determinable, not in conflict with those of emmonsite. Associated with very rich native gold ore, tellurite, and calaverite. In closed tube behaves like emmonsite, but without yielding selenium. Specific gravity about 4.53 after allowing for gangue. Composition: $TeO_2$, 70.71; $Fe_2O_3$, 22.76; $H_2O$ at 100°, 0.21; $H_2O$ above 100°, 4.54; $P_2O_5$, 0.34; $Al_2O_3$, 0.56; $SiO_2$, etc., 0.88. The ratios are no better than those afforded by the original emmonsite and the true formula still remains in doubt.

W. F. HILLEBRAND.

**Report on the Geology and Petrography of Shefford Mountain, Quebec.** BY JOHN A. DRESSER. *Geol. Survey Canada*, *13*, *Rep. L*, 35 pp.; plates.—This is a more extended treatment of the subject than appeared in the *American Geologist*, **28**, 203 (abstracted in this Journal, **24**, R 6). W. F. HILLEBRAND.

**Summary Report Geol. Survey, Canada, 1902.** 482 pp.; maps.—Among the numerous summarized papers in this report of the Director of the Survey, the "Preliminary Report on the Boundary Creek District, British Columbia," is the only one containing hitherto unpublished chemical matter. This is confined to two analyses by Dr. Dittrich (Heidelberg) of a rock intermediate between granite and diorite, and of a pulaskite. There are also a few data on the composition of ores from the Greenwood and Deadwood camps. W. F. HILLEBRAND.

**Carolina Tin Belt.** BY J. H. PRATT. *Extract from Min. Resources U. S. 1903*, "The Production of Tin in 1903," pp. 7–14. —The geology of the region as well as the mineralogical and chemical character of the ore are described.

W. F. HILLEBRAND.

**The Production of Precious Stones.** BY G. F. KUNZ. *Extract from Min. Resources U. S.*, *1903*, 71 pp.—The writer, as in many of his earlier reports, herein summarizes much from recent

literature pertaining to precious stones, their occurrence, etc., and presents here and there additional data collected by himself.

W. F. HILLEBRAND.

**Report of a Reconnaissance in Trans-Pecos, Texas, North of the Texas and Pacific Railway.** BY G. B. RICHARDSON. *Univ. of Texas Mineral Survey, Bull.* **9**, 111 pp.; map, plates.—Being undertaken primarily to determine the conditions of occurrence of underground water, the chemical matter of this report consists mainly of analyses of waters from various sources. There are also a few partial analyses of dolomites.

W. F. HILLEBRAND.

**[Radio-Activity of the Waters of Hot Springs, Arkansas].** BY BETRAM BOLTWOOD. *Report Secretary Interior for the fiscal year ending June 30, 1904*, pp. 211–213.—This is an abstract of a report by Dr. Boltwood to the Secretary of the Interior. The conclusions reached are: "(1) The waters of the springs on the Hot Springs Reservation are all radio-active to a marked degree. (2) The radio-activity of the waters is due to dissolved radium emanation (a gas), and not to the presence of salts of radium or other radio-active solids. (3) The tufa deposited by the springs does not contain appreciable quantities of radium compounds."

W. F. HILLEBRAND.

**The Quarrying Industry of Missouri.** BY E. R. BUCKLEY AND H. A. BUEHLER. *Missouri Bureau of Geol. and Mines, Vol. 2, 2nd Ser.*, 371 pp.; maps, plates.—This report should prove of more than local value, if for no other reason, because of the care with which the physical tests and the determinations of density, porosity, ratio of absorption, etc., have been carried out. It is pointed out that the value of similar tests published in some reports is little, because of the employment of inaccurate methods. Chapter III, in which there is a full discussion of porosity and ratio of absorption, will well repay perusal by all who have such tests to make. Both true porosity and ratio of absorption are given for all stones tested, although it is the former constant which is of greater importance in estimating the value of a stone, and the authors' methods for obtaining them and the specific gravity are described, as also those for ascertaining the effect of exposure to vapors of sulphur dioxide and carbon dioxide.

W. F. HILLEBRAND.

**Present Problems of Geophysics.** BY G. F. BECKER. *Science* 20, 545–556. **Problems of Geology.** BY C. R. VAN HISE. *J. Geol.*, **12**, 589–616.—These addresses, given at St. Louis in the Department of Geology of the International Congress of Arts and Sciences, contain references of interest to the chemist who has to do with mineralogy and geology.

W. F. HILLEBRAND.

## ANALYTICAL CHEMISTRY.

**A Rapid Method for the Determination of Total Sulphur in Iron by Evolution.** By S. S. Knight. *Am. Chem. J.*, 32, 84–85.—A weighed sample of 2 grams of iron and 1 gram of pure iron dust, reduced by hydrogen, are mixed in a small porcelain crucible and 1 gram of the iron dust is spread over the mixture so as to form a continuous covering. On this is placed a small disk of quantitative filter-paper. The crucible is then covered and heated for ten minutes at the highest temperature of the blast flame. After cooling, the sulphur is determined by the evolution method.

The results agree exactly with those obtained by standard gravimetric methods and the time required is less than half an hour. B. S. Cushman.

**Use of the Chromates of Barium and of Silver in the Determination of Sulphates and Chlorides.** By Launcelot W. Andrews. *Am. Chem. J.*, 32, 476–480.—Several years ago the author (*Am. Chem. J.*, 11, 567) described a volumetric method for determining sulphates which required the use of a solution of barium chromate in dilute hydrochloric acid. As the chromic acid gradually oxidizes the hydrochloric acid, he now substitutes trichloracetic acid as the solvent for the barium salt. All the other details of the method remain the same.

He also proposes a volumetric or colorimetric method for determining chlorides by agitating finely divided silver chromate with the chloride solution. After filtering or decanting, the chromate solution is titrated or compared colorimetrically with a series of known chromate solutions. The colorimetric process is much more rapid than any titration method and is at least as accurate for the most dilute solutions. B. S. Cushman.

**An Apparatus for the Direct Determination of the Specific Gravity of Cement.** By Daniel D. Jackson. *J. Soc. Chem. Ind.*, 23, 593–595.—With this apparatus, in which the burette is graduated to read directly in specific gravity, a determination, accurate to 0.01, may be made in about ten minutes.

B. S. Cushman.

**A Radically New Method for the Determination of Sulphur in Irons and Steels.** By H. B. Pulsifer. *Chem. News*, 90, 230–231.—In this method the sample is dissolved in chloric, hydrofluoric and hydrochloric acids; the residue is then filtered, fused with sodium peroxide, and the fusion dissolved in water and hydrochloric acid. Meanwhile the hydrofluoric acid in the first filtrate has been boiled off, and the two portions are now united and the sulphur precipitated as barium sulphate. The time between the weighing of the sample and precipitating the

barium sulphate need not be more than twenty minutes. The results obtained are in nearly all cases appreciably higher than those found by the standard method. B. S. CUSHMAN.

**The Iodimetric Determination of Copper.** BY ANDREW M. FAIRLIE. *Eng. Min. J.*, 78, 787–788.—The author modifies the method, as usually practiced, by precipitating the copper as cuprous sulphocyanate. The time required for evaporating the nitric acid from the original solution and in boiling the solution to precipitate the copper on zinc or aluminum is thus saved and comparative determinations, made on various grades of cupriferous material, agree almost exactly with those obtained by electrolysis.
B. S. CUSHMAN.

**Further Investigations with the Rotating Cathode.** BY H. E. MEDWAY. *Am. J. Sci.* 1, 18 (1904); *Ztscnr. anorg. Chem.* 42, 114 (1904).—It has been demonstrated in an earlier paper (Gooch and Medway, *Am. J. Sci.*, 15, 320 (1903) that copper, silver and nickel can be electrolytically precipitated from solutions of their salts with a great saving of time by using a rapidly rotating cathode and a correspondingly high current density. Cadmium in an acidified solution of its sulphate, tin in the form of ammonium stannous chloride, zinc in the form of a double oxalate, preferably that of potassium oxalate, and gold in ammoniacal solution of the potassium gold cyanide were very successfully deposited. The zinc does not form platinum black on a rotating cathode. The current densities run from 6.5 to 8.5 amperes per square decimeter and the time of deposition was from fifteen to thirty minutes. R. C. SNOWDON.

**The Material and Shape of the Rotating Cathode.** BY H. E. MEDWAY. *Am. J. Sci.*, 18, 180 (1904); *Ztschr. anorg. Chem.*, 42, 110 (1904).—In previous experiments (Gooch and Medway, *Am. J. Sci.*, 15, 320 (1903)) the use of the rotating cathode of platinum was recommended for rapid electrolytic analysis and in this paper the author shows the conditions under which the material and form of the cathode may be changed. The usual solution of acidified copper sulphate was used and standardized by means of the rotating platinum crucible as cathode. A silver crucible as cathode left little to be desired as to accuracy. The adhering copper was removed by rubbing, and by treatment with strong, hot, hydrochloric acid. Nickel changes weight in drying and cleaning too easily to be useful, and aluminum cannot be successfully separated from its film of oxide. Shepherd's disk cathode (*J. Phys. Chem.*, 7, 508 (1903)) operated better with a platinum strip as anode across the entire face of the cathode instead of a wire at the edge. R. C. SNOWDON.

**Comparison of a Wet and Crucible-fire Method for the Assay of Gold Telluride Ores. With Notes on the Errors Occurring in the Operations of Fire Assay and Parting.** By W. F. Hillebrand and E. T. Allen. *U. S. Geol. Survey, Bull. No. 253*, 31 pp.—By numerous tests on two gold telluride ores from Cripple Creek, Colorado, carrying from 14 to 20 ounces gold and from 2 to 3 ounces silver to the ton, it is clearly established that the crucible-fire assay for such ores gives results quite equal to those obtainable by the wet way, provided due corrections are made for slag and cupel losses. This is a confirmation of Furman's assertion, which is based on insufficient data. The gold loss in the slag, with the silicious ores operated on, was found to be small and generally negligible, but the cupel losses were very appreciable, and it is concluded that correction for such losses is not generally needless in all except very rich ores, as has been claimed. These errors, if uncorrected, far outweigh those due to inaccuracies in weighing on a good bullion balance.

In the course of their work the authors were led, by the conflicting statements met with in the literature and the contradiction certain of their experiments offered to widely prevalent views, to look into the subject of errors in cupellation and parting, with special reference to gold. On certain points their data are inconclusive, and circumstances forbade repetition in order to secure positive data, but with respect to others there is no doubt in their minds. It must be borne in mind that only fine gold and silver were used without admixture of copper, hence the conclusions as to cupellation are not applicable necessarily to coin bullion.

The cupellation loss of gold by volatilization is generally small as compared with that by absorption, and at a temperature allowing of the formation of abundant feather litharge is negligible, or perhaps compensated by retention of lead, but the case is otherwise at high temperatures, when it may average one-half of that by absorption in the case of a quartation alloy.

The loss of gold by absorption is a very important one, and is influenced far more than is generally supposed by slight changes in temperature. It is greater with pure gold and alloys poor in silver than with alloys rich in silver.

The conclusion perhaps most in conflict with popular belief is that there is absolutely no need for a higher temperature at the end of cupellation with gold beads than with those of silver. The most exact results were obtained when feather litharge was still abundant at the time of brightening. Furthermore, it is altogether unnecessary to leave gold beads in the muffle for some time after brightening in order to remove the last of the lead, for there is no loss in weight from so doing.

The error caused by retention of lead in the bead is one of some magnitude, if the results of two careful tests are to be depended

on, which showed 0.30 and 0.37 per cent. of lead respectively. The amount of this retention is not lessened by leaving the beads in the muffle for some time after brightening.

Although silver can be completely extracted from quartation alloys by nitric acid, it was frequently found that more than two repetitions of the acid treatment and subsequent washing were called for, if any certainty of complete extraction was to be expected.

Tests made with mixtures of pure nitrous and nitric acids show that the solvent action of the former is so slight, if indeed there is any at all, that it need not be considered as a possible disturbing factor in parting. Similarly it is shown that the losses in parting with pure nitric acid, whether traces of gold really dissolve or not, are quite negligible, in an ore assay, at least.

Numerous tables of tests accompany the text.

W. F. HILLEBRAND.

## ORGANIC CHEMISTRY.

**Present Problems of Organic Chemistry.** BY WILLIAM A. NOYES. Address delivered before the Congress of Arts and Sciences at St. Louis. *Science*, **20**, 490–501. *Chem. News*, **90**, 212–215 *and* 228–229.—The author dissents from the view which appears to be held by some chemists that only such knowledge as can be expressed in mathematical terms can properly be called scientific. Long experience of organic chemists in dealing with the cumulative, non-mathematical evidence upon which our knowledge of chemical structure is founded has led to a conviction that human knowledge is not bounded by the limits of sense-perception. It is impossible to conceive that those theories with regard to structure which have guided the work of thousands of chemists for the last fifty years do not in some measure express the actual truth with regard to atoms and their relation to each other in organic compounds.

A brief historical sketch is given of those steps which have led to our present views with regard to the structure of organic compounds, and the following principles are given as a conservative statement of our present knowledge: 1. That in organic compounds, at least, each atom is attached *directly* to only a limited, small number of atoms. 2. That in the sense of the order of the successive direct attachments the structure of a very large number of compounds is known with a degree of probability that amounts to practical certainty. The present problems in the science are, first of all, an extension of our knowledge of natural organic compounds, and the development of new synthetical methods. In addition to such work in rounding out the science along the lines of our present knowledge there is need of the study of much more fundamental problems, especially with

regard to arrangement of atoms in space, and the real nature of the relations between the atoms in chemical compounds. If we accept the theory of sequence of atoms in carbon compounds, there seems no reasonable possibility other than that van't Hoff's hypothesis is true in its broad outlines, but the hypothesis is not at present entirely satisfactory in its discussion of double and triple unions. In a brief digression the author criticizes Ostwald's view that the laws of multiple proportion and combining weights can be satisfactorily explained without the aid of the atomic theory.

In the latter part of the address a hypothesis, which is partly new, is developed with regard to the union of atoms in chemical compounds. The experiments of Theodore W. Richards, especially, have demonstrated that Faraday's law holds for different solvents and over a wide range of temperature and with a degree of accuracy which is of the same order as the laws of combination of elements by weight. We are dealing here with a unit quantity of electricity, which is not merely, however, a unit of electrical energy. It has been customary to think of this unit charge of electricity as being involved only in those reactions which occur in solution. If we accept the theory of electrons, it would seem that the unit charge is also involved in all other chemical reactions. (See Noyes and Lyons, *Ibid.*, 23, 460. Also Stieglitz, *Ibid.*, 23, 707.) The thought is suggested that every new combination of chemical elements is preceded by a dissociation which may in many cases occur only under the influence of the reacting substance and that the electrons or electrical charges of atoms not only play an important part in the union of atoms but that they may also produce a residual effect upon other atoms in the same compound. This gives a rational explanation for the very great differences in the stability of the union between carbon atoms in different compounds. There are many empirical rules with regard to such differences in stability but there have been few, if any, attempts to give any reason for these differences. It is suggested also that the unstable nature of double unions may be due to the presence of both a positive and negative electron in each of the atoms united, causing a lessening in the attraction between the electrons. In conjugated double unions it is suggested that of the four atoms involved the two central ones are likely to be positive and negative, respectively, and neutralize each other's attraction for outside atoms, while an intensified attraction for outside atoms would be found in the exterior atoms. The effect may be analogous to that of the attractive forces of a magnet which exhibit themselves chiefly at the ends. W. A. NOYES.

**The Preparation of Aromatic Nitroso Compounds.** BY FREDERICK J. ALWAY. *Am. Chem. J.*, 32, 385–392.—The author suggests the following general method for the preparation

of aromatic nitroso compounds, depending upon the reduction of nitro bodies to hydroxylamine derivatives, and oxidation of the hydroxylamines to nitroso compounds. If the corresponding nitro compound is volatile with steam, reduce it in alcoholic solution with zinc dust and acetic acid, treat the reduction product with ferric chloride, and distil with steam at once. If the nitro compound is not volatile with steam, after the oxidation with ferric chloride wash the oxidation product thoroughly with water to remove all iron, and extract the residue with a hot solvent. Nitroso compounds may also be formed by oxidizing amino compounds with Caro's reagent. In both cases, azoxy bodies are formed at the same time. EXPERIMENTAL.—*p-Nitrosobenzoic acid*, $ON.C_6H_4COOH$, prepared by the above method from *p*-nitrobenzoic acid, forms a yellow powder, decomposing above 250° without melting. On drying, it becomes insoluble in ordinary solvents. Dissolved in hot sodium carbonate solution and reprecipitated with acid, the moist precipitate dissolves in hot alcohol with a green color. It dissolves in ammonia with a yellow-green color, and is not volatile with steam. *Benzene-p-azobenzoic acid*, $C_6H_5N : N.C_6H_4COOH$, from *p*-nitrosobenzoic acid and aniline, separates from hot alcohol in orange crystals, m. p. 240° (uncorr.). *m-Nitrosobenzoic acid* forms a white solid, which blackens at 230° without melting. It is not volatile with steam, and forms green solutions. *p-Toluene-m-azobenzoic acid*, from *p*-toluidine and *m*-nitrosobenzoic acid, forms orange crystals (from alcohol), m. p. 192° (uncorr.). M. T. BOGERT.

**The Nitrosocinnamic Acids and Esters.** BY FREDERICK J. ALWAY AND WALTER D. BONNER. *Am. Chem. J.*, 32, 392–398. —*m*- and *p*-Nitrocinnamic acids are not volatile with steam, while their methyl and ethyl esters are difficultly volatile with it. Their nitroso derivatives show a similar behavior with steam, so that their purification is difficult and the yields of pure substance small. The para compounds are yellow. The methyl and ethyl esters of *p*-nitrosocinnamic acid also exist in an unstable green modification. *m*-Nitrosocinnamic acid is colorless, but its ethyl ester forms green crystals. Attempts to obtain *o*-nitrosocinnamic acid were unsuccessful. Apparently azoxy bodies are formed at the same time with the nitroso compounds. EXPERIMENTAL.—*p-Nitrocinnamic acid*, $O_2N.C_6H_4CH : CHCOOH$, was prepared from *p*-nitrobenzaldehyde, sodium acetate and acetic anhydride, and was then changed to *p-nitrosocinnamic acid* by the method given in the preceding review. The latter is a yellow powder, blackening above 220° without melting. When freshly prepared, it is soluble in alcohol or glacial acetic acid, giving yellowish-green or greenish-yellow solutions. *Ethyl p-nitrocinnamate*, when distilled with steam, forms white needles, m. p. 141°–142° (uncorr.). About 0.2 gram ester goes over with every kilo of

steam. *Ethyl p-nitrosocinnamate*, from the nitrocinnamate, crystallizes from dilute alcohol in yellow needles, which melt at 72°–73° to a green liquid. It gives greenish-yellow solutions with various solvents. On one occasion green crystals of the ester were obtained, but they changed to the yellow form before they could be dried. *Methyl p-nitrocinnamate* volatilizes very slowly in a current of steam. *Methyl p-nitrosocinnamate* forms lemon-yellow needles, which melt at 111°–112° (uncorr.) to a green liquid. On several occasions green crystals were obtained of the same melting-point. In the dark these green crystals do not appear to change, but in the sunlight they soon pass over into the yellow modification. *m-Nitrosocinnamic acid* forms stellate groups of minute white needles, which turn slightly brown in presence of air and moisture. It forms green solutions, and decomposes without melting, at 230°. *Ethyl m-nitrocinnamate* is slightly more volatile with steam than the isomeric para ester. *Ethyl m-nitrosocinnamate* forms bright green rhombic plates, m. p. 65°–66° (uncorr.), readily soluble in alcohol. In solution and when melted it is green. M. T. BOGERT.

**On Certain Nitrogen Compounds.** BY FREDERICK J. ALWAY AND REUBEN PINCKNEY. *Am. Chem. J.*, 32, 398–400.—Nitroso compounds, under certain conditions, react almost quantitatively with amino compounds to produce azo bodies—$RNO + H_2NR' = RN:NR' + H_2O$. The most favorable conditions appear to be secured by adding a hot acetic solution of the nitroso compound to a boiling acetic solution of the amino compound. By slightly varying the conditions, other reactions are induced. EXPERIMENTAL.—*m-Nitrobenzene-p-azobenzaldehyde*, $O_2NC_6H_4N:NC_6H_4COH$, from *m*-nitraniline and *p*-nitrosobenzaldehyde, forms orange-red granular masses, m. p. 223° (uncorr.), difficultly soluble in alcohol or acetic acid. *Ethyl p-Nitrosobenzoate*, $ONC_6H_4COOC_2H_5$.—Yellow needles, melting at 81° (uncorr.) to a green liquid. Its solutions are also green. *Ethyl p-azoxybenzoate*, $ON_2(C_6H_4COOC_2H_5)_2$, is formed, at the same time with the *p*-nitrosobenzoate, from the nitrobenzoate by reduction to the corresponding hydroxylamine and subsequent oxidation. It crystallizes from alcohol in orange leaflets, melting to a turbid liquid at 113°, which becomes clear at 120° (uncorr.). M. T. BOGERT.

**The Molecular Weights of the Yellow Nitroso Compounds.** BY FREDERICK J. ALWAY AND ROSS A. GORTNER. *Am. Chem. J.*, 32, 400–403.—The solid nitroso compounds may be grouped as follows: (1) green or blue, (2) colorless or white, and (3) yellow. The blue or green color has been shown to depend upon the monomolecular condition, while the white or colorless form indicates the dimolecular state. In a previous article by Alway and Bonner, the only yellow nitroso compound then known, *p*-

nitrosobenzaldehyde, was shown to possess a normal molecular weight in the solutions examined. Since then the methyl and ethyl esters of *p*-nitrosobenzoic and of *p*-nitrosocinnamic acids have been obtained and found to be yellow also. The authors determined the molecular weights of these four esters in freezing benzene. The amounts of cinnamic esters available were too small to give conclusive results. The *p*-nitrosobenzoic esters showed normal molecular weights. *Ethyl m-nitrosobenzoate*, $ONC_6H_4COOC_2H_5$, forms stellate groups of white crystals, which melt at 52°–53° to a green liquid. In solution it exists chiefly in the monomolecular condition. M. T. BOGERT.

**On the Reactions of Ethyl Chlorsulphonate.** BY O. W. WILLCOX. *Am. Chem. J.*, **32**, 446–476.—The alkylating effect of ethyl chlorsulphonate, $ClSO_2OC_2H_5$, is due to the fact that it suffers a methylene dissociation, $CH_3CH_2OSO_2Cl \rightleftarrows CH_3CH : + HOSO_2Cl$, at 160°. It is a much more energetic alkylating agent than the alkyl halides, reacting violently, for instance, with an absolute ether solution of ammonia at 0°, giving a mixture of di-, tri- and tetra-alkylated ammonium chlorides. Chlorsulphonic acid itself may further dissociate into $SO_3$ and HCl. Thus a chloroform solution of chlorsulphonic acid, treated at 0° with dimethylaniline, gave dimethylanilinesulphurtrioxide and dimethylaniline chloride in quantitative yield. In its reactions with ammonia, amines, alcohols, phenols and their salts, ethyl chlorsulphonate does not act in the molecular form, but by virtue of its being partly dissociated into ethylidene, sulphur trioxide and hydrogen chloride. With sodium alcoholates in absolute ether solution, and with sodiomalonic ester and allied compounds, it does apparently react in its undissociated form. In the former case, addition-products have been observed, while in the latter case it acts as a chlorinating agent, giving chlormalonic ester, $\alpha$-chloracetoacetic ester, etc. EXPERIMENTAL.—*The preparation of ethyl chlorsulphonate* is best carried out by allowing absolute alcohol to act upon sulphuryl chloride at low temperatures. The *action of chlorsulphonic acid on dimethylaniline* in chloroform solution at 0°, resulted in the formation of the hydrochloride of dimethylaniline and dimethylanilinesulphurtrioxide,

$$(CH_3)_2(C_6H_5)N\left\langle\begin{matrix} O \\ | \\ SO_2 \end{matrix}\right. .$$

The latter rearranges at about 60° to the isomeric dimethylaniline-*p*-sulphonic acid. *Ethyl chlorsulphonate and dimethylaniline*, in chloroform solution at 0°, react to give dimethylanilinesulphurtrioxide, ethyl chloride, ethyldimethylphenylammonium chloride and the dimethylaniline salt of dimethylaniline-*p*-sulphonic acid. *Dimethylanilinesulphurtrioxide* may also be prepared by the direct action of sulphur trioxide upon a well-cooled solution of dimethyl-

aniline in chloroform. It shows the properties of an unsaturated compound, absorbing water, alcohol, phenol, ammonia, primary and secondary amines, olefines, and acetone with great ease, to form addition-products of the general type $(CH_3)_2(C_6H_5)NH.OSO_2X$. With *water* the product is dimethylaniline sulphate, $C_6H_5N(CH_3)_2H_2SO_4$, m. p. 84°–85°, which loses water at 200° and gives dimethylaniline-*p*-sulphonic acid; with one molecule absolute *alcohol*, the ethyl sulphate, $C_6H_5N(CH_3)_2OSO_2OC_2H_5$, is obtained, needles, m. p. 54°, quite soluble in water or alcohol, and decomposed at 200°; with *acetone*, an addition-product is formed, large prismatic crystals, m. p. 76°–78°, soluble in water; *malonic ester* likewise gives an addition-product, white leaflets; with one molecule of *phenol*, the phenyl sulphate, $C_6H_5N(CH_3)_2OSO_2OC_6H_5$, results, crystalline and very soluble in water; with aqueous potassium hydroxide, it is decomposed quantitatively into potassium phenylsulphate, and this is probably the easiest way to prepare the latter substance; with one molecule of *aniline*, a wax-like sulphamate is produced, $C_6H_5N(CH_3)_2OSO_2NHC_6H_5$; with *trimethylethylene*, an indistinctly crystalline substance is formed, apparently

$$(CH_3)_2(C_6H_5)N.C(CH_3)_2.CH(CH_3).SO_2O.$$

*Ethyl chlorsulphonate and diethylamine*, in absolute ether at 0°, react to give diethylsulphamic acid $(C_2H_5)_2NSO_2OH$, tri- and tetra-ethylammonium chlorides. *Diethylsulphamic acid ethyl ester*, $(C_2H_5)_2NSO_2OC_2H_5$, from diethylsulphamic chloride and sodium ethylate, is a colorless pleasant-smelling oil, b. p. 119° at 15 mm. 126° at 22 mm. Heated at ordinary pressure, it decomposes. It is an exceedingly weak base. *Ethyl chlorsulphonate and ammonia*, in dry benzene or dry ether at low temperatures, react to form di-, tri- and tetra-ethyl ammonium chlorides. The formation of small amounts of mono- and diethyl sulphamic ethyl esters was also observed occasionally. *Ethyl Chlorsulphonate and Aniline.*—When ethyl chlorsulphonate is added to aniline without preventing the rise in temperature due to the reaction, much ethyl chloride and sulphanilic acid are formed. At low temperatures not a trace of these products is obtained. If the reaction is carried out in absolute ether solution at low temperature, the chief products are the hydrochloride of ethylaniline and phenylsulphamic acid. The *Action of Ethyl Chlorsulphonate on Alcohol and Sodium Alcoholates.*—The reaction with alcohol leads to the formation of varying proportions of hydrochloric acid, ethyl chloride, ether, sulphuric acid, and primary and secondary ethyl sulphates. With sodium alcoholates, in absolute ether solution, soluble and very stable addition-products are obtained, which are decomposed at once by the addition of cold water, giving varying amounts of alkyl ethyl sulphate, alkyl sodium sulphate, sodium sulphate,

alkyl ethyl oxide, and alkyl hydroxide. *Behavior of Ethyl Chlorsulphonate on Heating.*—If small amounts of ethyl chlorsulphonate are quickly distilled at ordinary pressure, it boils with noticeable decomposition at about 152°. If heated for some time in a bath at 160°, it decomposes into sulphur dioxide, sulphuric acid, ethylene, hydrogen chloride, and carbonaceous matter. Heated to 130° in presence of powdered tin and a trace of iodine, it yields ethylene, sulphur dioxide, stannic chloride, and small quantities of hydrogen chloride. A chloroform solution of chlorsulphonic acid containing traces of iodine will dissolve metallic tin in the cold, with brisk evolution of sulphur dioxide and formation of stannic chloride. *Ethyl chlorsulphonate and sodium acetoacetic ester* react in absolute ether solution, at low temperature, to form $\alpha$-chloracetoacetic ester, diacetosuccinic ester, sodium ethyl sulphite, and sodium sulphate. *Ethyl chlorsulphonate and sodium malonic ester*, under similar conditions, give acetylene tetracarboxylic ester $(ROOC)_2CHCH(COOR)_2$, as the chief product, due to the interaction of the chlormalonic ester first formed with unchanged sodium malonic ester. The *Reactions of Ethyl Hypochlorite.*—Ethyl hypochlorite and sodium ethylate in dry ligroin react almost instantly at 0°, but no trace of ethyl ether or of diethyl peroxide is formed. With diethylamine and with trimethylethylene it acts as a chlorinating agent, giving chlordiethylamine and chlorisoamylene. *Ethyl chlorsulphonate and sodium phenolate* in dry ether at 0° yield phenetol. M. T. BOGERT.

**On a Dihydro-quinoxaline from Ortho-phenylene-diamine and Mesityl Oxide.** BY JOHN B. EKELEY AND ROBERT J. WELLS. *Univ. Colorado Studies*, 2, 123–133.—The hydrochloride of a dihydroquinoxaline is obtained by dissolving $o$-phenylene diamine in excess of dry acetone and passing in dry hydrochloric acid gas. The same product results when mesityl oxide is used instead of acetone, indicating that in the first reaction mesityl oxide is probably first formed and then condenses with the diamine. The free base is obtained, if mesityl oxide and the diamine are heated together in benzene solution. It crystallizes from benzene in large straw-colored monoclinic prisms, m. p. 124° (uncorr.), slightly soluble in water, soluble in most organic solvents and in acids. The reaction by which it is formed is probably as follows:

$$C_6H_4\begin{cases}NH_2\\NH_2\end{cases} + OC\begin{cases}CH_3\\CH{:}C(CH_3)_2\end{cases} = C_6H_4\begin{cases}NH—C—CH_3\\ \qquad\ \ \|\\NH—C—CH(CH_3)_2\end{cases} + H_2O.$$

*Monohydrobromide*, $C_{12}H_{16}N_2.HBr$, lemon-yellow crystalline pow-

der. *Dihydrobromide*, $C_{12}H_{16}N_2.2HBr$, colorless needles. *Monohydrochloride*, lemon-yellow crystalline powder. *Dihydrochloride*, long, colorless needles. *Picrate*, $C_{12}H_{16}N_2.2C_6H_2(OH)(NO_2)_3$, canary-yellow needles. *Chlorplatinate*, $(C_{12}H_{16}N_2)_2H_2PtCl_6$, beautiful yellow needles. *Dinitroso Derivative*, $C_{12}H_{14}N_2(NO)_2$, yellow crystals, m. p. 177°. *Dibenzoyl Derivative*, $C_{12}H_{14}N_2(COC_6H_5)_2$, small, lemon-yellow needles of indefinite melting-point. The free base is not attacked by sodium and hot alcohol. It is, however, very sensitive to oxidizing agents, which apparently convert it into a quinoxaline and another dihydroquinoxaline. It gives characteristic precipitates with solutions of various salts, that with mercuric chloride being lemon-yellow, and that with copper sulphate light green. M. T. BOGERT.

**The Origin and Nature of Color in Plants.** BY HENRY KRAEMER. *Proc. Am. Phil. Soc.*, 43, 257–277.—Colors in plants may be divided into two classes: (1) those which are associated with the plastids, or organized bodies in the cell; and (2) those which occur in the cell-sap, or liquid of the cell. The cell-sap colors generally differ from the plastid colors in being insoluble in ether, xylene, benzene, chloroform, carbon bisulphide, and similar solvents, but soluble in water or alcohol. Tables are given showing the solvents used in extracting the color principles from various plants, and the change in the color caused by the action of various chemical reagents. The green color of plants is due to a definite pigment, chlorophyl, contained in a chloroplastid. The yellow color substance of roots, flowers and fruits is due to a pigment, called by the author "chromophyl," and contained in a "chromoplastid." The yellow color principle of the inner protected leaf buds is termed by the author "etiophyl," and is contained in an "etioplast." The blue, purple and red color substances in flowers are dissolved in the cell-sap. Color substances corresponding to these latter are also found in spring and autumn leaves. The author believes the function of the chromoplastids to be the manufacture or storing of nitrogenous food materials, while he considers the cell-sap colors to be incidental to physiological activity, and of secondary importance in attracting insects for fertilizing the flower and dispersing the seed. The cell-sap colors are very sensitive to reagents, and this probably accounts for the great variety of colors in flowers and leaves.

M. T. BOGERT.

## PHARMACEUTICAL CHEMISTRY.

**Elixirs.** BY H. C. BRADFORD. *Merck's Rep.*, 13, 315.—A discussion of elixirs in general and formulas for the following elixirs: Iron, quinine and strychnine; compound salicylic; gentian and iron; buchu, juniper and potassium acetate; acetan-

ilide; three chlorides; bromo-chloral compound; poppy compound; "simple" and "aromatic." These are all permanent preparations and leave little to be desired as far as pleasant flavor and palatability are concerned. W. H. BLOME.

**A Container for Fluids which Spoil on Exposure to Air.** BY E. H. GANE. *Merck's Rep.*, 13, 327.—The description is accompanied by an illustration of the container which can be easily made of any size and of a variety of materials. It is intended to be used for the storage of many liquids which are apt to spoil upon exposure to the atmosphere. W. H. BLOME.

**Adulterants of Essential Oils.** BY L. H. TURNER. *The Pharm. Era*, 32, 548.—The high price of essential oils as well as the difficulty of detecting adulterations has led unscrupulous dealers to practice sophistication. The oils are mixed with cheaper ones of similar odor, oil of turpentine, alcohol, paraffin and spermaceti. The latter are used to cause the mixture to congeal readily in order to closely simulate the pure oil. The physical properties are frequently depended upon to indicate the presence of any foreign substance, while the experienced perfumer depends largely upon the odor of the sample. The cheaper oils usually contain oil of turpentine, the presence of which can be recognized by an expert by rubbing a drop of the oil on a piece of glass and noting the odor. In case another essential oil was used as the adulterant, its presence is detected by fractional distillation. The same method is used to establish the presence of fixed oils, paraffin and spermaceti. Alcohol may be detected in this way; also by taking a measured quantity of the suspected oil in a graduated cylinder, adding water to a definite quantity and shaking. Any noticeable diminution in the volume of the oil is generally due to the fact that alcohol has been removed by the water. It is at the same time a rough quantitative method. Nitrobenzene may be detected by shaking the oil with 45 per cent. alcohol and then allowing to settle. In case of the presence of the suspected substance, it will collect at the bottom of the container. W. H. BLOME.

**Progress in Pharmacy.** BY M. I. WILBERT. *Am. J. Pharm.*, 76, 581.—A sample of matico oil, examined by Professor Thoms, separated a mass of crystals on standing, which proved to be identical with asarone, and to be present to the extent of 10 per cent. Former samples of matico oil had been found to contain apiol, while this one contained none. The same author reported upon some opium grown in Germany. The average yield of 100 poppy heads was 1.27 grams which contained 6.6 per cent. of morphine.

Green cardamom differs from the cardamom as ordinarily met with in being air-dried and not stove-dried and bleached, and in

having a much sweeter and stronger flavor than the latter. While the cost of production of the green cardamom is less, the price is higher.

The nux vomica tree bears clusters of greenish or yellow fruits of the size of an apple. The seeds are embedded in a soft pulp which is eaten by monkeys and birds. The best seeds are obtained by collecting the fruits and separating the seeds from these, while inferior qualities are picked up from the ground.

Professor Tschirsh concludes that nearly all of the known plants yielding rhubarb belong to one of three varieties—*Rheum palmatum*, *R. officinale*, and *R. collinianum*. Chinese rhubarb usually consists of a mixture of several varieties of rhubarb, some of which are still unknown. Chemical examinations have shown a decided variation in emodine content of the several varieties, ranging from 4 per cent. in Chinese rhubarb to 1.8 per cent. in *R. collinianum*. *R. palmatum*, grown in Berne, Switzerland, yielded 2.8 per cent. of emodine, and is the variety recommended by the investigator to be grown for medicinal purposes.

Payet has found that tragacanth does not contain an active oxydase as acacia does. Therefore, to detect acacia as an adulterant in tragacanth he recommends this test: Mix a 1–30, cold, aqueous solution of the gum with an equal volume of a 1 per cent. aqueous solution of guaiacol and to this add a drop of hydrogen peroxide. The mixture will remain unchanged, if pure tragacanth be present, but will turn brown in the presence of acacia.

Poisoning by wood alcohol in its various forms was reported upon at the meeting of the American Medical Association. The following are given as crude forms of wood alcohol: Wood alcohol, wood spirit, pyroligneous spirit, wood naphtha and methylated spirits; the following as deodorized products: Columbian, Colonial, Union, Eagle, green wood and standard wood spirits. It is contended that wood alcohol in any of its forms is a dangerous poison, threatening both life and eyesight. At least 153 cases of blindness and 122 deaths are charged to its use.

Almatein is another substitute for iodoform, and consists of a combination of formaldehyde and hematoxylin.

Digalen is obtained from digitalis and is stated to be a soluble digitoxine and chemically identical with it. The dose is from 0.003 to 0.012.

Eucaine lactate is used in 2 to 5 per cent. solution as a local anesthetic in ophthalmic and dental practice, and in 10 to 15 per cent. solution when used in the nose or ear.

Euporphine is a methyl bromide compound of apomorphine and is recommended to supplant the latter. Medium dose is 0.02 gram.

Glycosal is a mono-salicylic acid glycerin ester, recommended

to be used as a substitute for salicylic acid in the treatment of rheumatism.

Isoform has antiseptic and deodorant properties. It is sold in mixture with calcium phosphate and as a glycerin paste.

Styracol, the cinnamic acid ester of guaiacol, is a non-toxic preparation of guaiacol which has been used in intestinal colic and diarrhea. W. H. Blome.

## SANITARY CHEMISTRY.

**Sewage Purification Works under Construction at Minworth Greaves, England.** *Eng. Record,* 50, 417–419.—A description of the extension of the sewage plant of the Birmingham, Tame and Rea District Drainage Board, for the bacterial purification of sewage. The mean dry weather flow averages 22,000,000 gallons per day, and the method of treatment until February, 1901, was chemical treatment followed by broad irrigation. In 1901 the addition of lime to the sewage was suspended, and the chemical deposition tanks were used for septic action, resulting in a saving of $15,000 to $20,000 a year for lime and a reduction of 35 per cent. in the amount of sludge formed and no deterioration on the character of the effluent from the subsequent land treatment. The extension of the plant is situated about five miles from the outfall sewer at Saltley and the effluent from the septic tanks at that place is brought in a conduit of some 6,000,000 imperial gallons capacity, allowing of some considerable saving of septic tank capacity at Saltley. The sewage from the conduit enters an intake chamber in which there is fixed a hydraulic gate, forming part of an apparatus for automatically regulatiug the flow of sewage. An overflow weir is fixed in the upper part of the chamber over which in time of storms the excess of dilute sewage will pass. The sewage from the intake chamber passes to five Dortmund tanks, 44 feet in diameter, and 33 feet, 6 inches in depth. Each tank has a cubical capacity of about 161,000 gallons. The normal flow through each tank of 42,000 gallons per hour gives an upward velocity through the cylindrical portion of the tank of 4.4 feet per hour, and a period of deposition of four hours. The sewage, from which about 70 per cent. of the suspended matter is thus removed, is carried by a system of cast-iron pipes, varying from 36 to 21 inches in diameter to the experimental percolating beds. Of these there are five, four of which are circular, each of one-fourth acre area, and one is rectangular, of one-half acre area. The circular beds are constructed above ground level and are 120 feet in diameter, the average depth of filling material being 7 feet. The rectangular bed is constructed below ground level and the depth of filling material is 6 feet. The filling material in Bed A consists of 3 feet of 2½-inch gauge broken and screened hard ball slag, 1 foot of 1½-inch, 1 foot of 1-

inch, 2 feet of ½-inch, and the sewage is distributed by Mather & Platts' revolving distributor. The filling material in Bed B is screened gravel containing some stones, 3 feet of 2½-inch gauge, 2 feet of 1½-inch, 1½ feet of 1-inch, and 6 inches of ½ to ¼-inch. The distributor is of the Adams type, somewhat modified and fitted with vanes to assist it in windy weather. Bed C has for filling material broken blue bricks, 3 feet of 2½- to 3-inch gauge, 1¾ feet of 1½-inch, 1½ of 1-inch, and ¾ foot of ½-inch. The sewage is applied by means of a mechanical distributor of the Scott-Moncrieff type. Bed D, one-half of the bed is filled to its whole depth with granite chippings from ¾ to 1½ inches in size, the other half with granite of the following sizes and depths, 5 feet of 2½- to 3½-inch, 1½ feet of 1½- and ½ foot of ¾-inch. The sewage is distributed by means of a Candy, Whittaker, Bunjant distributor. Bed E, the rectangular bed, is filled with screened ashes and clinkers from the city of Birmingham's Gas Works, the lower 3 feet being from 3 inches to 6 inches, and the upper 3 feet of that passed through a 1½-inch screen. The sewage is distributed by a system of fixed sprays. All the beds have concrete bottoms and three of the circular beds have also aërating floors made of semicircular stoneware tiles, upon which the filling material is laid. The aërating floors prevent the bottom of the bed from becoming filled with suspended matter, rendering it useless for drainage and aëration, as the effluent after percolating through the bed is at once removed from contact with the filling material and the suspended matter is carried by the flow into the channels and there dealt with. The effluent from these beds runs into a sedimentation tank to arrest the humus which all percolating filter effluents contain, and then run on to the farm lands. The analyses of the effluents show that a very high nitrification is obtained, which the author believes is largely due to the aërating floors, combined with large size filling material for the lower portion of the beds. There is also now under construction four more percolating beds, each of one acre area, 460 feet long and 100 feet wide, floor of concrete, covered with an aërating floor of semi-circular stoneware tiles, on which the filling material is to be laid, broken blue bricks in two of the beds, and granite chippings in the other two. The sewage is to be applied by means of fixed sprinklers.

LEONARD P. KINNICUTT.

**Analyses of Chicago Market Milk.** BY EDWIN O. JORDAN. A Report by the Health and Sanitation Committee of the Civic Federation of Chicago, July, 1904. *Methods Employed.*—The samples were purchased in the open market, under the usual conditions, in bottles and in bulk; when the latter, the milk was poured into clean glass receptacles. They were then taken immediately to some place suitable for the work and the specific

gravity and temperature at once determined. The specific gravity was obtained with a Quevenne lactometer after thorough mixing, and is corrected to 15°. The samples were plated as soon as possible. This work was accomplished almost invariably within thirty minutes after collection and usually within fifteen minutes. One cubic centimeter of the milk was diluted with sterile water 1–10,000 and 1 cc. of this mixture plated. With this dilution, numbers given as under 100,000 are probably somewhat higher and those above 5,000,000 somewhat lower than the true figures. The culture medium used was 10 per cent. nutrient gelatin of 5 per cent. acid reaction. The medium contained 2 per cent. of lactose and enough litmus solution to impart a deep blue tinge. The plates were incubated regularly for seventy-two hours at 18°–20° before counting. In the determination of total solids, 5 grams of milk were weighed into porcelain evaporating dishes and evaporated to dryness over a water-bath. The residue was then thoroughly dried over calcium chloride and weighed twenty-four hours later. The fat determination was made by the usual Babcock test. The acidity was determined by the use of Farrington's alkaline tablets in the usual way. Each sample of the milk was tested for the presence of formalin (hydrochloric acid and ferric chloride method); salicylic acid (ether and ferric chloride method); boric acid and borax (alcohol solution of total solids ignited for green flame). The legal standard for milk in Chicago is 12 per cent. solids, and 3 per cent. butter fat. The general summary of the 291 chemical analyses and the 288 bacterial analyses, which are given in full, is stated by the author in the following tables:

GENERAL SUMMARIZATION.

*Fat Content.*

| | | Percentage of whole. |
|---|---|---|
| Number of samples below 1 per cent. | 2 | 0.687 |
| " " " 1 per cent. and below 2 per cent. | 12 | 4.12 |
| " " " 2 per cent. and below 3 per cent. | 64 | 22.0 |
| " " " 3 per cent. and below 4 per cent. | 165 | 56.7 |
| " " " 4 per cent. and over | 48 | 16.5 |
| Percentage of all samples below legal standard | | 26.8 |
| " " samples from restaurants below legal standard | | 57.5 |
| " " " " stores " " " | | 31.33 |
| " " " " dairies and milk depots | | 14.25 |

*Total Solids.*

| | | |
|---|---|---|
| Number of samples below 11 per cent. | 25 | 8.6 |
| " " " 11 per cent. and below 12 per cent. | 65 | 22.3 |
| " " " 12 " " " " 13 " " | 131 | 34.7 |
| " " " 13 " " " over | 70 | 24.0 |
| Percentage of all samples below legal standard | | 30.9 |
| " from restaurants below legal standard | | 60.0 |
| " " stores below legal standard | | 35.0 |
| " " depots and dairies | | 14.3 |

*Bacteria per Cubic Centimeter.*

| | | Percentage of whole. |
|---|---|---|
| Number of samples below 50,000 | 4 | 1.4 |
| " " " 50,000 and below 100,000 | 10 | 3.5 |
| " " " 100,000 and below 1,000,000 | 89 | 30.0 |
| " " " 1,000,000 and below 20,000,000 | 138 | 47.5 |
| " " " 20,000,000 and over | 47 | 16.0 |
| Average bacteria per cc. during April (last 20 days) | 9,361,000 | |
| " " " " " May | 10,071,000 | |
| " " " " " June (first 9 days) | 18,924,000 | |
| " percentage total solids, all samples | | 12.41 |
| " " fat content, " " | | 3.37 |
| " " acidity, all samples | | 0.1966 |

*Formalin.*

| | |
|---|---|
| Percentage of the 291 samples containing formalin | 4.8 |
| " " all samples during April | 3.125 |
| " " " " " May | 2.11 |
| " " " " " June (first 9 days) | 13.20 |
| " " " " (7) from residences | none |
| " " " " (33) " restaurants | 15.0 |
| " " " " (134) " stores | 3.7 |
| " " " " (112) " dairies, depots, etc. | 3.57 |
| Acidity, 0.200 and over | 28.5 |

The analyses were made from April 11 to June 9, 1904, and the increase of bacteria follows the increase in daily temperature to a remarkable extent. In April, the average was 9,361,000, in May 10,071,000, and the first nine days of June 18,924,000 per cubic centimeter. The range was from 10,000 to 74,000,000. If judged from the legal limit established by the Boston Board of Health, April 29, 1904, 500,000 bacteria per cubic centimeter, 77 per cent. of Chicago samples would be condemned. "The presence of preservatives in a considerable percentage of the samples analyzed is worthy of notice. Nearly 5 per cent. of the total showed the application of formalin. In 3.125 per cent. from all sources during April formalin was found, while in May only 2.11 per cent. from all sources was proved. During the nine days in June the samples collected from all sources showed 13.20 per cent. containing formalin, a great increase with the oncoming of warm weather. A significant showing is that no samples collected in residences showed formalin, while of those collected in restaurants 15 per cent. of the total contained this preservative."

LEONARD P. KINNICUTT.

**The Bacterial Contamination of Milk and Its Control.** BY F. C. HARRISON. *Trans. Canadian Institute*, 7, 3, pp. 469-496. —The number of bacteria found in milk varies greatly as is shown in the following table, which is a summary of the analyses given.

| City. | Source. | No. of bacteria per cc. | Average. | Authority. |
|---|---|---|---|---|
| Wurzburg | ...... | 220,000–2,300,000 | ...... | Clauss |
| Munich | ...... | 200,000–6,000,000 | ...... | Knapp |
| Warsaw | ...... | ...... | 4,000,000 | Bujwid |
| Amsterdam | Fresh milk | ...... | 2,500,000 | Geuns |
| Halle | Market | 6,000,000–30,700,000 | ...... | Renk |
| Giersen | ...... | 83,000–169,000,000 | ...... | Uhl |
| London | ...... | ...... | 500,000 | Rowland |
| St. Petersburg | ...... | 400,000–115,300,000 | ...... | Sacharlekoff |
| Dorpat | ...... | 10,000,000–30,000,000 | ...... | Knochenstiern |
| Boston | Clean stable, sterilized bottle | ...... | 530 | Sedgwick |
| Boston | Farm stable | ...... | 30,500 | Sedgwick |
| Boston | Milk-men | ...... | 2,350,000 | Sedgwick |
| Boston | Groceries | ...... | 4,577,000 | Sedgwick |
| New York | ...... | 250,000–5,000,000 | ...... | Park |
| Montclair, N. J. | Best dairies | ...... | Below 15,000 | Leighton |
| Montclair, N. J. | Poorly equipped | ...... | 40,000–70,000 | Leighton |
| Montclair, N. J. | No equipment | ...... | Above 180,000 | Leighton |
| Middletown, Ct. | ...... | 11,000–85,500,000 | ...... | Loveland and Watson |
| Madison, Wis. | Milk-men | 15,000–2,000,000 | ...... | Loveland and Watson |
| Guelph, Ont. | Market | ...... | 650,000 | Harrison |

The bacteria in milk comes from (1) the fore-milk, (2) the animal and the milker, (3) dirty air, (4) unclean utensils, and the relative importance of these factors fluctuates in each individual instance. The udder of the cow almost always contains bacteria, and consequently a larger number of bacteria are found in the fore-milk than in the middle or last milking, and the writer of the paper, as the result of a large number of examinations, gives 25,000–50,000 as the average in fore-milk, while the number in the after-milk depends upon whether the milking is done quickly or slowly. When done quickly very few are found, when done very slowly they were found in one case to equal 57,000. The number of species found in the udder of cows is very small. *B. acidi lactici* (Conn. No. 206) and *B. lactis aërobans* (Conn. No. 197) are the only ones that have been found constantly present, and they compose at least 95 per cent. of the bacteria present. The following species have been only more or less variably present, and in no case in large numbers.

*B. Halofaceins* (N. Sp.) *Micrococcus varians lactis* (Conn. 113 and 114), *Bacillus No. 18*, Conn., *Bacillus No. 7*, *Bacterium No. 8*, *B. exiguum* (Wright) 44, *Micrococcus No. 10*.

Though the number of bacteria in the udder of a cow may be large, yet, except in very rare cases, the species present are not harmful to the milk consumer. Still, as it is desirable to keep the number of bacteria in milk as low as possible, it is advisable to milk the first few streams into a separate utensil. Contamination from the animal and milker can, to a very large extent, be prevented by moistening thoroughly the flanks and udders of the cow before milking, by using a covered pail with small opening, and by the milker putting on a clean cotton or lined smock over his clothes, and invariably washing his hands immediately before milking. The milking machines which have been recently introduced are not, according to the data given by the author, entirely satisfactory, and the same may be said as to the cleaning of milk either by filtering through gravel, or by centrifugal force. The contamination of the milk from the air of the stable depends upon the condition of the stable. Much benefit would ensue either from moistening the fodder, or from feeding and bedding an hour or so before milking commences, to allow the dust, etc., of the air, time to settle. In many of the more modern dairy farms, the stables are thoroughly cleaned and ventilated, the floors sprinkled, and the manure removed from the building before milking commences, or a milking room is provided, into which the cows, one, two or three at a time, are brought for milking. This room is supplied with water conveniently located, and kept in an absolutely clean condition. Contamination from dairy utensils can only be prevented by neatness. The pails should be without seams, and the bottoms should be concave and

not convex, and after washing with boiling water, should, if possible, be placed over a steam jet for a few minutes. As temperatures above 50° F. are the most suitable for the increase of bacteria in milk, the milk should be cooled immediately after milking and kept at a low temperature. Of late years a number of sanitary dairies have been established in the neighborhood of large cities in various parts of the United States and Canada. Such milk is known as "hygienic," "sanitary" or "certified" milk and it has been shown that when milk is secured under as nearly aseptic conditions as possible the bacteria can be kept as low as 330 per cubic centimeter. In certain cities milk coming from sanitary dairies is endorsed by a Board or Commission. The Milk Commission of the Medical Society of New York endorses milk when the acidity is below 0.2 per cent. and does not contain over 30,000 bacteria to the cubic centimeter. The Milk Examiners Commission of the Philadelphia Pediatric Society give their endorsement to milk free from pus and injurious germs and having not more than 10,000 bacteria to a cubic centimeter. The adoption of a numerical standard by cities is most advisable and it has been suggested that 50,000 organisms per cubic centimeter should be a maximum limit in milk intended for food. Dr. Park, of New York City, thinks that any intelligent farmer, with sufficient cleanliness and a low temperature, can supply milk averaging not over 100,000 bacteria per cubic centimeter, when twenty-four hours old, and suggests that the sale of milk should be so regulated that that containing more than this number per cubic centimeter should be excluded from the market. Rochester, N. Y., has already tried the enforcement of this standard, with good results. LEONARD P. KINNICUTT.

**The Mechanical Filters of the Hackensack Water Company.** *Eng. Record*, 50, 572–574, 590–592.—A description with drawings of the mechanical water filters under construction by the Hackensack Water Company, which supplies water from the Hackensack River to Hoboken, and thirty-three smaller cities and towns of New Jersey, with a total population of 225,000. There are eight filter tanks each of which is a concrete monolith 46 feet 6 inches long, 25 feet 10 inches wide and 9 feet 6 inches deep. Each filter is divided longitudinally by a reinforced concrete wall 30 feet wide over all, which is the inlet for the raw water, and the main outlet for wash water, and contains the main air pipe, compressed air being used for stirring the sand when washing the filter. Each filter has therefore two independent sand beds with a combined area of 1,089 square feet. Over the strainers and air pipes there will be graded gravel and filter-sand. The gravel will be graded from ⅛ to ½ inch in size. The filter sand is required to have a uniformity coefficient of 1½ and an effective size

between 0.42 and 0.50 millimeter ; not more than 1 per cent. of it may be smaller than 0.2 millimeter. LEONARD P. KINNICUTT.

## INDUSTRIAL CHEMISTRY.

**Notes on Lutes and Cements.** BY S. S. SADTLER. *Proceedings Engineering Club of Philadelphia*, October, 1904.—The formulas here given are those applicable to engineering work and arranged according to the various uses.

In a previous paper published by the *Journal of the Franklin Institute*, May, 1904, the general subject was discussed and formulas given under a chemical arrangement rather than one based on the applications.

The conditions of application enumerated are :

(*a*) Heating the composition to make it plastic until firmly fixed in place.

(*b*) Heating the surfaces.

(*c*) Applying the lute with water or a volatile solvent, which is allowed to volatilize.

(*d*) Moistening the surfaces with water, oil, etc. (the menstruum of the lute itself).

(*e*) Applying the lute in workable condition and the setting taking place by chemical reactions.

(*f*) Setting by hydration.

(*g*) Setting by oxidation.

In the more recent paper, a number of compositions are described under fourteen headings.

(*1*) *Water Proof.*—Of use to engineers are fluid asphalt coatings for reservoir walls, concrete foundations, etc. Benzene (crude) is recommended as a diluent. Tar and pitch are not regarded as so suitable on account of water, light oils, free carbon, etc.

(*2*) *Oil Proof.*—A stiff paste of slightly diluted glycerol and litharge, mixed, only when ready for use.

A solution of silicate of soda (35° Bé) made into a stiff paste with precipitated carbonate of lime, magnesium carbonate or white lead, which increase the quickness of setting in the order named.

(*3*) *Acid Proof.*—Two formulas under this heading are : Boiled linseed oil and fire-clay, and "black putty" made by mixing equal portions of gas-tar, linseed oil, and dry china clay.

(*4*) *Resisting Hydrocarbon Gases.*—Silicate of soda of about 42° Bé mixed with inert material, as clay, sand, or asbestos.

(*5*) *Chlorine Resistant.*—The following is much used for electrolytic chlorine work, etc. Powdered glass, Portland cement and silicate of soda each one part, and a small amount of powdered slate.

(*6*) *Elastic Cements.*—Hart's India rubber cement. Equal

parts of pure linseed oil and clean unvulcanized rubber are mixed, the rubber being previously dissolved in the least amount of carbon disulphide possible.

(*7*) *General Purposes.*—Plaster of Paris, mixed with asbestos, straw, plush trimmings, hair, broken stone, etc., used according to temperature, strain and other conditions. A putty of flour and molasses is very useful.

(*8*) *Marine Glue.*—Crude rubber, 1 part; shellac, 2 parts; and pitch, 3 parts

(*9*) *Gasket Composition.*—Hard pitch for high temperatures. Silicate of soda mixed with silica, clay, asbestos, carbonate of lime, caustic lime, magnesia and oxides of heavy metals.

(*10*) *Machinists' Cement.*—Linseed oil, 6 parts; rubber, 1 part; linseed oil and red lead (sets hard); linseed oil and oxide of iron (does not set so hard); fish oil and red lead (does not set so hard).

(*11*) *Leather Belting Cements.*—Equal parts of good hide glue and American isinglass softened in water for ten hours and then boiled with tannin until the whole mass is sticky. Cement applied hot to roughened joint.

(*12*) *Iron and Stone Cements.*—Stone cement: Zinc or magnesium oxide, 2 parts; zinc or magnesium chloride, 1 part; powdered stone as diluent; water to make paste. Iron cement: Iron filings, 40 parts; manganese dioxide, 10 parts; salammoniac, 1 part; Portland cement, 20 to 40 parts; water to form paste.

(*13*) *and* (*14*) *Core Compounds and Briquette Binders.*—Dextrin, starch, and starch products, molasses, clay, loams, bituminous coal, pitch, asphalt, tar, oxychloride, and Portland cements.

S. P. SADTLER.

**Cementing Power of Road Materials.** *U. S. Department of Agriculture, Bureau of Chemistry, Bulletin No. 85.*—The only test that has so far been found effective is an impact test. One kilogram of rock is crushed to pass a 6 mm. but not a 1 mm. screen. This is then ground in a ball mill with two chilled steel balls, which weigh 25 pounds each and revolve at a rate of 2,000 revolutions per minute, reducing the broken stone in two and one-half hours to a powder that will pass through a 0.25 mm. mesh. The dust so formed is mixed with water to a stiff dough and kept in a jar for twenty-four hours. Twenty-five grams of the dough are then compressed into briquettes of 25 mm. diameter at a pressure of 100 kg. per square centimeter. As it is important that the compression be effected in a uniform manner, a special machine consisting of a long and short arm lever with weight is used. The die containing the discharge is forced by hydraulic means against this lever, or arm, and carries it ⅛ inch, at which point an electric circuit is closed and the water is shut off. These briquettes are dried twelve hours, each in the air and a steam-bath. The briquette is tested by means of a small trip-

hammer and the fall of the hammer is accurately measured and especially the drop which causes a "failure" of the briquette, is recorded.

Various tables are given showing the distribution of different rock materials in different states but a few well-known materials are given in the following table:

| | |
|---|---|
| Basalt (trap) | 91 |
| Conglomerate | 154 |
| Dolomite | 31 |
| Diabase (trap) | 26 |
| Felsite | 34 |
| Flint | 31 |
| Gneiss | 6 |
| Granite | 10 |
| Limestone | 63 |
| Marble | 5 |
| Quartzite | 4 |
| Sandstone | 63 |
| Schist | 23 |
| Shale | 314 |
| Slate | 176 |

S. P. SADTLER.

**Kryptol, a New Substance for Electric Heating.** BY FRANK W. MASON. *Western Electrician*, October 29, 1904.—Kryptol is a mixture of carbon, carborundum and clay. It is furnished in four degrees of coarseness for different purposes. Essentially this material is designed to furnish a high degree of heat by electrical resistance without being destroyed by oxidation (combustion) or disintegration. The kryptol is loosely strewn on an earthenware plate, which has depressions for holding the resisting material. Lesser or greater heat up to the melting-point of nickel (1,600° C.) may be obtained by varying the strength of current or the amount of the kryptol layer. S. P. SADTLER.

**Oxide Purification.** BY E. H. EARNSHAW. *Am. Gas Light J.*, October 31, 1904.—The comparisons of various forms of iron oxide, used in purifying gas are given: No. 1, oxide made from planer chips and borings; Nos. 2 and 3, similar oxides obtained from well-known manufacturers; No. 4, oxide made from copperas alone; No. 5, iron ore; Nos. 6 and 7, oxides in very fine powder mixed with sawdust.

Bog iron ore when used in larger amount gave rise to back pressure.

The oxide made from copperas alone gave interesting results as follows: First fouling, 100 per cent.; second fouling, very small; third fouling more than second but about one-third of the theoretical.

A chemical examination of this oxide showed that the greater portion of the original oxide had been changed to cyanides and consequently was incapable of further purification. These tests

TABLE I.

| Examination. | 1. | | 2. | | 3. | | 4. | 5. | 6. | 7. |
|---|---|---|---|---|---|---|---|---|---|---|
| Weight per bushel dry | 25.01 | | 23.0 | | 31.0 | | 0.4 | 26.1 | 39.6 | 32.7 |
| Oxidized per bushel, pounds | 11.6 | | 7.9 | | 2.5 | | 1.25 | 11.8 | 17.4 | 16.2 |
| Total iron per bushel, pounds | 12.5 | | 10.2 | | 17.75 | | 1.25 | 11.8 | 17.4 | 16.2 |
| Possible sulphur per bushel, pounds, based on oxide, iron | 9.9 | | 6 8 | | 10.73 | | 1.07 | 19.1 | 14.9 | 13.9 |
| Pounds of sulphur | *a* | *b* | *a* | *b* | *a* | *b* | | | | |
| Taken up per bushel, first fouling | 0.61 | 2.57 | 0.96 | 1.85 | 1.26 | 1.45 | 1.11 | 8.0 | 6.28 | 5.02 |
| Efficiency per cent | 26.3 | 26.0 | 14 1 | 27.2 | 11.8 | 13.5 | 1.00 | 79.3 | 42.1 | 36.2 |
| Second fouling in pounds | 1.79 | 1.55 | 0.84 | 1.82 | 1.39 | 1.05 | 0.29 | ...... | ...... | ...... |
| Efficiency per cent | 18.0 | 15.6 | 12.3 | 26.7 | 12.9 | 9.8 | 27.1 | ...... | ...... | ...... |
| Third fouling | ...... | ...... | 1.19 | ...... | 0.79 | ...... | 0.54 | ...... | ...... | ...... |
| Efficiency per cent | ...... | ...... | 17.5 | ...... | 7.4 | ...... | 36.4 | ...... | ...... | . .... |

showed very clearly that, in the case of an oxide made from borings, a part of the iron may be inactive to hydrogen sulphide, even though the iron itself be completely oxidized. Oxide made from copperas on the other hand is very active, but too expensive, if used alone.

The chief problem involved in the manufacture of oxide is to get the greatest proportion of the oxide chemically *active to hydrogen sulphide*. This is best done by keeping the mass thoroughly wet during the process of oxidation. To determine the influence of salt, tests showed that ¼ pound, to the bushel gave about the best results. The efficiency of the oxide purification carried out by the author's company, has improved from 27.2 per cent. to 51.5 in two years.

Analysis of oxide made from planer chips is as follows:

| | |
|---|---|
| Weight per bushel (2,150 cubic inches) dry | 26.1 pounds |
| Actual iron per bushel | 13.7 " |
| Theoretical amount of sulphur that can be taken up at one fouling without air | 11.7 " |
| With coal gas containing 350 grains $H_2S$ per 100 cubic feet equivalent to purifying per bushel | 23,400 cu. ft. |
| With water gas, containing 175 grains $H_2S$ per 100 cubic feet equivalent to purifying per bushel | 46,800 " " |

It was found that the best temperature for purifying is from 85° to 100° F. The oxide must not be too cold or it will not react. The admission of air with the gas increased the work performed by the oxide, but it is probable that the gain in the cost of purifying is offset by the loss in candle-power. The investigation, as stated by the author, is not complete. S. P. SADTLER.

**The Generation of Steam by Waste Heat from Water-Gas Sets.** BY DONALD McDONALD. *Am. Gas Light J.*, October 31, 1904.—With the exception of domestic heating, the generation of steam is practically the only way the waste heat from water-gas sets may be utilized.

This waste heat may be recovered from four distinct sources, as follows: First, the sensible heat of the escaping gas-blast products; second, the chemical energy in combustibles remaining in the blast products; third, the sensible heat of the escaping water-gas; fourth, the latent heat of all vapors in the water-gas, which condense at high temperatures.

The values here given are only designed to be approximate:

| | |
|---|---|
| Weight of 1,000 cubic feet of enriched water gas | 48 pounds |
| Specific heat of enriched water gas | 0.46 |
| Weight of 1,000 cubic feet of blast gases | 86 pounds |
| Specific heat of blast gases | 0.24 |
| Volume of blast gases for each 1,000 of enriched water-gas | 2,457 cu. feet |
| Temperature of escaping water-gas | 1,450° |
| " " " blast-gases | 1,550° |
| " to which these gases may be cooled | 450° |

From the above assumptions, the heat capable of being re-

covered for each 1,000 cubic feet of enriched water gas is as follows:

| | | |
|---|---|---|
| From the blast-gases............... | 86 x 0.24 x 1,000 x 2.457 | = 55,783 heat units. |
| " " hot water gases......... | 48 x 0.46 x 1,000 | = 22,080 " " |

Figures for the heat in combustibles and latent heat in vapors are not given but are thought to be considerable. The boiler for utilizing this heat should be provided with an air-blast for burning the combustibles.

A comprehensive sketch accompanies the article.

S. P. SADTLER.

**Utilization of Waste Heat from Water-Gas Sets for the Generation of Steam.** BY A. B. MACBETH. *Am. Gas Light J.*, October 31, 1904.—In the experiments carried out by the author two water-gas sets were operated together, blowing and running alternately. The length of both runs and blows was six minutes each, so that the heat supplied to the boilers was continuous and all steam used in generators after sets was made in this boiler. The average pressure carried in the boiler was 25 pounds. No down runs were made. The average results of several days' tests gave an evaporation of 38.9 pounds per 1,000 cubic feet of gas made when only the sensible heat in the waste gases was used, or when the other boilers were kept closed.

The average of several analyses of the escaping blast gases showed CO equal to 7.36 per cent. by volume.

With the 6-inch boiler blast-valve 3 inches open during a part of a day's test, 67.3 pounds of water were evaporated per 1,000 cubic feet, an increase of 73 per cent.

The author figures that with boiler fuel at $2.00 per ton and using 16 pounds to the 1,000 cubic feet of gas made, and figuring that 100 lbs of steam per 1,000 are required to operate an 8-foot 6-inch set, making 900,000 cubic feet per day, the saving, without considering labor, would be $8.80 per day or 0.98 of a cent per 1,000 cubic feet.

If the sensible heat of the carburetted water-gas was used, a saving of $10.22 per day could be made. S. P. SADTLER.

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## AGRICULTURAL CHEMISTRY.

**Investigations in Soil Management.** BY F. H. KING.—"The six papers constitute the report of the Chief of the Division of Soil Management, for 1902 and 1903, but the three here printed have been refused departmental publication by the Chief of the Bureau of Soils." This note, on the title-page of the pamphlet, is self-explanatory.

The first paper, "The Influence of Farmyard Manure upon the Water-soluble Salts in Soils," gives the yields of corn and po-

tatoes produced upon four poor soils and upon four good soils, as a result of applying varying amounts of farmyard manure. The poor soils used were a Norfolk sandy soil and a Selma silt loam at Goldsboro, N. C.; a Norfolk sand and a Sassafras sandy loam at Upper Marlboro, Md. The four good soils were a Hagerstown clay loam and a Hagerstown loam at Lancaster, Pa., and a Janesville loam and a Miami loam at Janesville, Wis. The manure was applied at the rate of 5, 10, and 15 tons per acre, leaving one check plot in each series, also one to which 300 pounds of Acme guano per acre were applied. This series of five plots was repeated four times, using a two-acre area in each instance. The yields of corn and potatoes on these eight soil types, as given by tables, show an increase with increasing amounts of manure used, though the smallest application gave the largest increase per ton, and all "results show that both relatively and absolutely, adding fertilizers to the poorer soils has had a greater effect than the same treatment with stronger soils."

The amounts of the salts recoverable from these eight soil types, after being washed three minutes with distilled water, increased in general with the amounts of manure applied. With nitrates, however, "not infrequently less rather than more were recovered from the soils to which most manure had been applied, but this was reversed where lime was used in connection with manure. The soluble-salt content of the plant sap varies, on the eight soil types, with the applications of manure made.

The second paper is a study of the "Movement of Water-soluble Salts in Soils." Data taken from field conditions show an unequal distribution of water-soluble salts under and between rows of potatoes and peas even to the depth of four feet, where ridge and furrow cultivation had been practised.

Cylinders, two for each type, were filled with soil from the eight types mentioned in the first paper. Through the soil, by capillarity was passed a solution containing the ordinary water-soluble salts of soils. In one of each pair of cylinders this was followed by distilled water.

A determination of water-soluble salts at successive depths in these soil columns showed a wide variation in the distribution of the different salts,—the nitrates, sulphates and chlorides showing a general tendency to concentrate near the surface, potassium calcium and magnesium, also, but to a lesser degree, while silica, phosphoric acid and carbonic acid remained more equally distributed.

Sand, rendered nitric-acid-free by repeated washing with disulphonic acid, and then treated with a nitrate solution, would not yield, by repeated three-minute washings with distilled water, all the nitric acid it was known to contain and which a treatment with disulphonic acid revealed. "These and the previous ob-

servations point strongly to the retention of nitric acid, in some manner, by soils and indicate that the close and slowly moving layers of water which move over the surfaces of soil grains and granules, by capillarity, are able to wash them more thoroughly than is practicable by simple agitation in water, or by the percolation of water through them."

An examination for water-soluble 'salts in columns of soils, with and without a three-inch dust mulch, shows that with this treatment these salts are held well below the surface in reach of the feeding-roots of the plant, instead of being concentrated at the surface, as they are without the dust mulch. With nitrates the effect is noticeable to the depth of 12 to 15 inches. Cultivation which does not provide a dust mulch, results in a concentration of soluble-salts at the surface, where they are then easily removed by surface drainage.

The third paper, "Absorption of Water-soluble Salts by Different Soil Types," presents the observations of Way, Voelcker, O. Kullenberg and E. Peters upon this subject. From these "it seems * * * that little or none of the negative radicles are absorbed by soils, with the exception of phosphoric and silicic acids." Samples of the eight soil types were treated with five times their weight of a solution containing potassium, calcium, magnesium and nitric, phosphoric, sulphuric and hydrochloric acids in approximately the same concentration as found in soil solutions. The determinations of the absorption of these salts by the different soils show "that very strong differences may exist in the absorptive power of different soils and that * * * we must expect to find that soils having a high absorptive power, are capable, under favorable conditions, of giving larger yields than those having smaller absorptive power."

Three samples of black marsh soil, one of which had grown good corn, another poor corn and a third no corn, when treated with dilute plant-food solutions, showed marked differences in their ability to absorb the various elements of plant food.

J. H. PETTIT.

**Soil Management.** BY E. W. HILGARD. *Science*, **20**, 605–608.—Three of six papers, comprising the report of Prof. F. H. King of the Division of Soil Management, have been published by the author at Madison, Wisconsin, instead of by the United States Department of Agriculture, and the author of this article endeavors to show why they were refused departmental publication by the Chief of the Bureau of Soils.

In regard to the well-planned investigations and the results, "the only criticism which could, perhaps, be made of the work leading to these conclusions—from an outside view point—is that they are so clearly and thoroughly in accord with all former ex-

perience, both practical and experimental, that they are largely foreseen."

"To the unofficial mind it appears as an admirable piece of work in a line but little touched by agricultural investigators thus far and manifestly likely to lead to important new lights, as well as to definite quantitative corroboration of old ones."

The results, however, do not agree with the published views of the Bureau of Soils, as given in Bulletin 22, and in this fact "evidently lies the clue to their rejection." J. H. PETTIT.

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## PATENTS.

JUNE 28, 1904.

763,859. James D. Darling, Philadelphia, Pa. **Separating carbon** from other material in powder. Oil is added to the mixture, and the whole agitated under a body of water and beneath a foraminous partition through which a downward current of water is maintained. Adapted for graphite.

763,923. Maurice W. Phillips, Philadelphia, Pa. Assignor to Pennsylvania Clay Co., New Jersey. **Clay slip.** The material is finely pulverized and suspended in water and pressed over a vacuum screen to separate fine from coarser particles.

JULY 5, 1904.

764,002. Cassius C. Peck, Rochester, N. Y. Process of **measuring heat** in hot-water heating systems. The volume of heat flowing through a radiating device is automatically recorded on a chart mechanically moved at uniform speed whereby the quantity for a given time is known, while at the same time the temperature of the inflowing and outflowing current is continuously automatically recorded, and the product of the weight of fluid for a given time into the average difference of temperature measures the heat supplied.

764,003. As above for the **apparatus** adapted to carry out the above process.

764,044. Christian Diesler, Coblenz, Germany. **Smelting** and **reducing metals.** Metallic salts in coarse fragments are compressed in closed retorts with exclusion of air, a resistance in the retort, and an electric current passed through, the evolved gas raising the pressure above five atmospheres, by which combination and reduction are effected at a low temperature.

764,072. Mike Perry and Alexander Dickson, Tacoma, Washington. **Fire kindler.** Crude oil is poured over a mixture of sawdust, paper and shavings, melted resin is added as a binder and the whole molded.

764,099. Otto P. Amend, New York, N. Y. **Desulphur-**

**izing oil.** The oil is treated with copper hydroxide to remove sulphur compounds as copper sulphides, which are oxidized by ferrous hydroxide and neutral ferrous sulphate to soluble copper sulphate in a current of air, the copper salt being removed and the oil settled.

764,138. John C. Mallonee, Charlotte, N. C. Assignor one-half to John J. Mallonee, Crichton, Ala. Apparatus for **distilling oil.** Four retorts are arranged stepwise, with three condensers over them, a final condenser at a lower level, and suitable connecting pipes.

764,174-5-6-7-8. All to Wm. H. Bristol, Hoboken, N. J. **Thermoelectric apparatus.** The first for a couple of wolfram steel and nickel or nickel alloy, the second has a junction reduced in cross section below the ends, the third adds a liquid bath of molten lead, tin, etc., and measures the temperature at the ends of the couple, the fourth has conductors of material different from that of the primary couples and forming secondary couples, and the fifth introduces an article to be treated as part of the circuit.

764,183. Thomas A. Edison, Llewellyn Park, N. Y. **Separating liquid globules** from gases generated in a storage battery, by projecting the globules against a liquid film which arrests the globules but allows the gases to pass through. The film is composed of the electrolyte caught between a valve and its seat.

764,250. Heinrich Mielck, New York, N. Y. **Magnesia cement.** Calcined magnesia 100, magnesium chloride 35, slaked lime and ammonia soda residue 5 each, clay 25, and sand 1000 parts.

764,251. Emil Naumann, Cologne, Germany. **Ammonium nitrate.** Sodium nitrate and ammonium sulphate are dissolved and boiled in water, thereby precipitating sodium sulphate; the lye is filtered and cooled to the limit of saturation for ammonium nitrate, whereby a double salt of ammonium-sodium sulphate is precipitated, and then by rapid cooling ammonium nitrate alone is thrown down and separated.

764,294. John A. Just, Pulaski, N. Y. **Dried milk.** A cream-white, porous fluffy, flaky powder, readily soluble in water, containing all the solid ingredients of milk, and germ-free (especially suitable for children traveling).

764,320. Desiderius Turk, Riesa, Germany. Assignor one-half to Franz Josef Maly, Aussig, Austria-Hungary. **Heating gas.** Producer gas is made by blasting a poor fuel with carbon dioxide and steam, and this is passed through a bed of hot coals of good quality from which a better gas has been blasted, whereby the carbon dioxide is made carbon monoxide and the steam de-

composed, and as soon as the temperature of the bed of coals falls below the working point, shutting off the producer gas and again blasting the coals, and repeating the operation.

764,350. Antonino Ciolfi, Cleveland, Ohio. Apparatus for measuring the **time an explosive is burning.** The powder is placed between a fixed and a movable abutment, the latter being connected with a chronograph and two electromagnets, one of which starts the chronograph at the moment of ignition and the other stops it when the combustion ceases.

764,404. Joseph P. Wickersham, Clifford W. Tabler and John W. Stewart, Martinsburg, W. Va. **Insecticide.** Lime 12 pounds are slaked in a tank and 15 of sulphur added and boiled, salt 4 added and boiled again. Ferric sulphate $^1/_{100}$, and mercury $^1/_2$ oz. and the whole stirred, cooled and strained.

764,443. Walther Feld, Honingen-on-Rhine, Germany. **Hydrocyanic acid.** Alkalies are added to ferric cyanides to precipitate ferric hydroxide, mercuric chloride is added together with a chloride of aluminum or zinc and an alkali, the mercury cyanide is separated and decomposed by acids.

764,453. Gustav Geissler, Sr., and Gustav Geissler, Jr., Gratz, Austria-Hungary. **Cement.** The raw materials are burned in pure oxygen and then granulated.

764,483. Jules Maggi, Paris, France. **Extracts.** Tablets of extracts are made by incorporating a carbonate and an acid adapted to make a gas with the extract, forming the tablets under pressure, expanding the gas by heat, and drying the porous mass, which is very soluble.

764,526. Manuel C. Gama, Tacubaya, Mexico. **Artificial fuel.** Crude oil and residuum 10 each, tallow and sawdust 5 each, coal dust and caustic soda 1 part each.

JULY 12, 1904.

764,595. Hugo Jone, Chicago, Ill. Converting **heat energy into electrical energy.** A battery having a positive plate of metallic tin and an alkali as an electrolyte, oxidizing the tin to produce electricity and precipitating the oxidized tin by barium hydroxide, and reducing the barium stannite formed by carbonaceous fuel, the waste gases being used to heat the galvanic cell, and repeating the oxidation of the recovered metal.

764,733-4-5. All to Richard Lauch, Uerdingen, Germany. The first for **black sulphur dye,** from *p*-aminodinitrodiphenylamine in solution heated with alkaline sulphides to 180° C. It is a black hygroscopic powder, soluble in sodium sulphide solution green, turning blue on oxidation, insoluble in alcohol and giving on unmordanted cotton with alkaline sulphides deep blacks, becoming faster on treatment with metallic salts. The second patent is for the same process with the addition of water and

glycerol to the first mixture, and the last consists in increasing the stability of the above dyes by a partial oxidation in a powdered state by air.

764,776. Johannes Selwig, Brunswick, Germany. **Nitrating fibrous matter.** The fibers are placed in the basket of a centrifugal, and the nitrating acid is caused to circulate through the fibers from within, out, and back again.

764,810. Charles W. Jefferson, Schenectady, N. Y. Assignor to Mica Insulator Co., N. Y. Mica **insulation.** Pieces of mica are coated with shellac and cemented together by heat and pressure.

764,811 and 764,812 are to the same inventor for **automatic apparatus** for carrying out the above process.

764,837. Wilhelm Berchelmann, Elberfeld, Germany. Assignor to Elberfeld Co. of N. Y. Blue **anthraquinone dye.** Sulphonic acids of methylaminoalphyl-amino-$\beta$-methyl anthraquinones, whose alkaline salts are dark powders, soluble in water blue, and dyeing unmordanted wool from cold baths blue.

764,849. George A. Hubbard, Chicago, Ill. **Core compound.** Hydrous calcium sulphate, stucco, flour, starch and sawdust. Proportions to suit the quality of iron.

764,863. Wm. B. D. Penniman, Baltimore, Md. **Extracting resin** from pine wood. The wood is steeped in a hot liquid and the pressure reduced over it, whereby the resin is driven out of the wood and rises to the top of the fluid, to be removed.

764,872. John H. Stewart, Williamsport, Pa. **Finishing wood.** A solvent, as caustic potash, is applied to the softer parts of the grain which are dissolved so that the hard portions remain raised above the surface by dissolving away the soft parts, and wood alcohol is applied, the result being a printing surface.

764,890. Joseph G. Hendrickson, Philadelphia, Pa. Assignor to Marsden Co., same place. **Journal packing.** Cornstalk pith separated from the fibers is charged with oil.

764,913. Sidney B. Chapman, Abbeville, Ga. **Solution for preserving lumber.** Water 93, sulphuric acid 7, mercuric chloride $^1/_{20}$ per cent. and salicylic acid 1 per cent.

764,938. Benjamin E. Gage, Chicago, Ill. **Nature prints.** Leaves, etc., are laid on a sensitized surface and exposed, the leaves are then skeletonized and the skeleton laid on the same surface in proper registry and further printed, or the skeleton is placed in the negative outline of the object, a positive print taken from the combination, and a negative made from that.

764,964. Nathan Sulzberger, New York, N. Y. **Preventing fires.** The building is filled with a permanent atmosphere of carbon dioxide, together with a perfume.

W. H. SEAMAN.

# REVIEW OF AMERICAN CHEMICAL RESEARCH.

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WILLIAM A. NOYES, Editor.



## INORGANIC CHEMISTRY.

**The Interaction of Hydrochloric Acid and Potassium Permanganate in the Presence of Ferric Chloride.** BY JAMES BROWN. *Am. J. Sci.*, 19, 31.—The article is chiefly a refutation of the results of Wagner ("Maasanalytische Studien. Habilitationsschrift," Leibig, 1898). Wagner reports that more permanganate is decomposed by hydrochloric acid in the presence of ferric chloride than with ferric chloride absent. To explain this catalytic action of ferric chloride, Wagner assumes the intermediate formation of a chlorferrous acid. The author repeats the experiments of Wagner, observing the same conditions of concentration, temperature, etc. The results are tabulated. He found that the variations in Wagner's results disappeared if the free chlorine liberated during the interaction of hydrochloric acid, in the presence or absence of ferric chloride, was removed by a current of carbon dioxide before the excess of permanganate was determined by standard oxalic acid and permanganate in the usual way. When this was done the same amount of permanganate was decomposed by hydrochloric acid, whether ferric chloride was present or not. The author concludes that Wagner's results in no way show the catalytic action of ferric chloride, but are simply an indication of greater or less retention of chlorine in solution, and greater or less oxidation of oxalic acid by chlorine during the titration of the amount of unchanged permanganate. L. W. JONES.

**Radio-Activity of Underground Air.** BY H. M. DADOURIAN. *Am. J. Sci.*, 19, 16.—Elster and Geitel, and others have shown that air and underground air are radio-active. From the rate of decay and other properties the presence in air of a radio-active gas

similar to radium emanations has been established. The activity of this gas decays just about as fast as that of radium emanations, or to half value in about three days and a half. But the rates of decay of the excited activities, obtained by exposing a negatively charged wire to air and to radium emanations, do not agree. Rutherford and Allen found forty-five minutes for the half-value period of air-excited activity, whereas radium excited activity (after two hours) fell to half value in twenty-eight minutes. The presence of thorium emanations together with radium emanations might account for the slow decay, for the half-value period of thorium excited activity is about eleven hours. Bumstead showed (*Am. J. Sci.*, **18**, 1) that the excited activity obtained by exposing a negatively charged wire to open air is fairly accounted for by the assumption that both radium and thorium emanations are present in air.

By experiments with the excited activities produced by pure radium emanations and by pure thorium emanations, and by a comparison of the rates of decay of the excited activities produced by these, with the rate of decay of excited activity produced by ground-air, the author shows that ground-air excited activity is to be attributed chiefly to radium and thorium excited activities, the former in a much greater degree. The ground-air excited activity, however, decays at a slightly slower rate than a combination of radium and thorium excited activities in the same proportion as they occur in ground-air excited activity. No explanation of this difference is attempted.

L. W. JONES.

**Palladium.** BY JOSEPH WHARTON. *Proc. Am. Phil. Soc.*, 43. —The author gives an account of the methods employed in the separation of palladium from nickeliferous pyrrhotite, found around Sudbury, Ontario, Canada, in Laurentian and Huronian rocks. These deposits have been recently the most important source of nickel. The ore contains copper, silver, gold, platinum and palladium, the latter to the extent of about 0.01 ounce per ton. Nickel varies from 1.5 to 8 per cent., while copper varies from 1 to 4 per cent. Palladium is secured by the following process: The ore is roasted in open heaps and then smelted. To separate nickel and copper from the matte, which contains 30 per cent. of these metals, together with the precious metals, it is melted with niter-cake and coal in a cupola furnace. When the charge is run out of the furnace it separates into two layers, the bottom layer contains nickel and metals of the platinum group; the top layer, sodium sulphide, copper sulphide, etc. In the refining process (not given) which follows, palladium is obtained as a slime, which contains one thousand times as much palladium as the original ore, and the metals of platinum group, besides gold and silver. This slime is melted and refined in a small reverberatory furnace, from which it is ladled out into water, in

which it sinks in the form of coarse shot. These shot are charged into small leaden towers, and hot dilute sulphuric acid is run over them until they are disintegrated. Nickel, copper, etc., dissolve, while palladium and other precious metals are left in the form of a black mud, which contains about 25 per cent of palladium. This mud is treated with aqua regia, platinum is precipitated by ammonium chloride, and from the filtrate palladium is separated electrolytically. The deposit is ignited in a reducing atmosphere. The Oxford Copper Co. obtains 3,000 ounces of palladium annually from about 300,000 tons of Canadian ore.

L. W. JONES.

**The Precipitation of Barium Bromide by Hydrobromic Acid.** BY NORMAN C. THORNE. *Am. J. Sci.*, 18, 441.—The article deals with the separation of barium bromide by the agency of hydrobromic acid. Series of quantitative results are given in tabular form. A concentrated solution of pure barium bromide was mixed with a saturated solution of hydrobromic acid and ether in the proportion of 1 : 1. The precipitated bromide was washed with the mixture (1 : 1) of hydrobromic acid and ether. The results obtained by weighing the dried precipitate were not quite uniform, possibly because of the formation of barium oxybromide. If the precipitated barium bromide, before it is dried, is treated with ammonium bromide, and is dried, first at low temperature and then at 250° until ammonium bromide is expelled, the results are uniform and quantitative. Barium may be separated from calcium and magnesium in this way.

L. W. JONES.

**Beryllium and Glucinum.** BY C. L. PARSONS. *Science*, 20, 809.—The author comments upon the request of the Council of the American Chemical Society that the choice between the names beryllium and glucinum be decided by the International Committee on Atomic Weights. He points out that beryllium has the sanction both of priority and of usage. The discoverer of the element, Vauquelin, in his first paper used the name "la terre du Béril." In a note at the end of Vauquelin's article, the editors, Guyton and Fourceroy, suggested "glucine." It seems that this term was rather reluctantly used by Vauquelin in his second paper; also in the third paper, with the remark, "on a donné le nom glucine." Berylerde was used by German and Swedish chemists. In time this gave way to beryllium, and glucine was changed to glucinum. The authors point out that all leading chemical journals, except the French, use beryllium (Italian, berille).

L. W. JONES.

**Glucinum and Beryllium.** BY J. L. HOWE. *Science*, 21, 35. —The author criticizes the article by Charles L. Parsons (*Science*, 20, 809). He maintains that the name "glucine" really has

priority, because it was accepted by Vauquelin at the suggestion of the editors of his first article on the new element. Concerning usage, Mr. Howe remarks, that the index (1903) of the *Journal of Chemical Society* of London gives "beryllium, see glucinum," and that glucinum is used by French, American and English journals. L. W. JONES.

**"Beryllium" or "Glucinum."** BY C. L. PARSONS. *Science*, **21**, 273.—The author, in reply to the article referred to in the preceding abstract, points out that "Dr. Howe .... admits that Vauquelin did not name the element or oxide; that he in fact would probably have liked to name it 'beryllium,' really adopting glucine in his fourth publication under virtual protest and that the clause 'la terre du Beril' used by Vauquelin in place of a name was literally translated into German as 'Berylerde,' becoming a definite name, used to this day, before Vauquelin consented to the use of 'glucine.' I think, also, that he will not question the fact that when it came to the actual use of the terms themselves Wöhler separated and described 'beryllium' (*Ann. d. Phys.* **13**, 577) before Bussy prepared glucinum (*J. de Chim. Medical*, 4, 453) although they were but a few weeks apart." As to usage, the Germans, Swedes, Danes, Russians, Dutch and Italians use "beryllium" exclusively; the French use "glucinum" exclusively; while English and American journals use both names. The name "glucinum" does not appear in the *Journal of the Chemical Society* (London) for several years previous to 1903. W. A. NOYES.

## MINERALOGICAL AND GEOLOGICAL CHEMISTRY.

**Report of Progress in the Geological Resurvey of the Cripple Creek District, Colorado.** BY W. LINDGREN AND F. L. RANSOME. *U. S. Geol. Survey, Bull. No.* 254, 36 pp.—When Messrs. Cross and Penrose made their examination of this district ten years ago, developments had reached no great depth and their conclusions naturally need some slight modifications in the light of the recent work of the authors. Chemical matter is wanting, but the discussion of the character of the ores and of the type of deposits, the extension in depth of the oxidized ore and the relation of the ore-bodies to depth, upon which the future of the district depends, forms interesting reading to the geological chemist.

"The characteristic feature of the Cripple Creek ores is the occurrence of the gold in combination with tellurium, chiefly as calaverite, but partly also as the more argentiferous sylvanite, and probably to a minor extent as other gold, silver and lead tellurides. The tellurides are frequently associated with auriferous and highly argentiferous tetrahedrite, with molybdenite, and occasionally with stibnite. While these minerals have not yet

been closely studied, preliminary examination indicates that their contents in gold are due to an intimate mechanical mixture of tellurides. Pyrite, while widely disseminated through the country rock and of common occurrence in the fissures, is rarely sufficiently auriferous to constitute ore. Such of the pyritic ores as have been tested reveal the presence of tellurium, indicating that the ore is a mixture of pyrite and gold-silver tellurides. Galena and sphalerite occur in small quantities in many of the mines, but rarely contain enough of the precious metals to form ore. Native gold appears to be absent from the telluride ores, except as it may be set free by the oxidation of these tellurides........Oxidized ores........are of relatively less importance than when Penrose described the district. They contain the characteristic dull gold, often in pseudomorphous skeletons resulting from the oxidation of the tellurides, associated with tellurite........emmonsite or durdenite........and probably other oxidized compounds of tellurium and iron. These minerals occur in association with kaolin, alunite and ferruginous clays. The deep workings of the present day show that kaolin is always connected with oxidation, and is not a product of the original mineralization of the district, as was supposed by Penrose. The Cripple Creek ores, as a rule, contain very little silver, the average proportion being about 1 ounce of silver to 10 ounces of gold." The nitrogenous gases which have given so much trouble in some mines (see also this Journal, 26, R 203) are believed to represent the last exhalations from the throat of the extinct Cripple Creek volcano. W. F. HILLEBRAND.

**A Geological Reconnaissance across the Cascade Range near the Forty-Ninth Parallel.** BY G. O. SMITH AND F. C. CALKINS. *U. S. Geol. Survey, Bull. No.* 235, 103 pp.; map, plates.—A considerable portion of the paper is devoted to a description of the igneous rocks of the region, but without chemical data. The rocks composing this portion of the range belong mainly to great batholithic masses of rather acidic composition.

W. F. HILLEBRAND.

**A Preliminary Report on the Coal Deposits of Georgia.** BY S. W. MCCALLIE. *Geol. Survey of Georgia, Bull. No.* 12, 121 pp.; maps, plates. The chemical matter of this report is confined to a few proximate analyses. W. F. HILLEBRAND.

**A Theory of Origin for the Michigan Gypsum Deposits.** BY G. P. GRIMSLEY. *Am. Geologist,* 34, 378–387.—From a comparative study of the Michigan occurrences and the conditions prevailing to-day in and around the Caspian sea, it is regarded as probable that the former are due to the gradual drying-up of a former sea, in which, as the depth decreased, ridges became exposed, thus forming basins in which all degrees of concentration would be found. The normal order of deposition would be cal-

cium carbonate, gypsum, salt. Where the gypsum now has no salt cover the salt is found in solution beneath it in the underlying sandstones. It has presumably been removed from its original position above the gypsum and carried downward by percolating waters. W. F. HILLEBRAND.

**Peat in Canada.** BY R. CHALMERS. *Geol. Survey Canada, Bull. on Peat*, 40 pp.—Beside matter of a general character and descriptive of Canadian peat occurrences, the Canadian and European processes for converting peat into fuel are briefly described. W. F. HILLEBRAND.

**A Peculiar Occurrence of Bitumen and Evidence as to Its Origin.** BY WM. CONGER MORGAN AND MARION COLVER TALLMON. *Am. J. Sci.*, **18**, 363–377; plates.—A fossil egg found in a large limestone pebble embedded in placer gravels of the Gila river in Arizona, contained crystallized colemanite and an asphalt-like substance. The latter is held to be derived from the original contents of the egg, while the colemanite came, of course, from without. The reasons for this belief as to the tarry matter are given in detail and are of considerable interest, especially for their bearing on the origin of bitumen in nature. Concerning this point the authors say: "This specimen presents, then, one of the very few instances, possibly the only one, in which conclusive evidence is at hand to connect bituminous matter with the original material from which it has been derived by a natural process without abnormal conditions," for it was shown by experiment that the egg can never have been exposed to a high temperature. Though sulphur was found in the tarry matter, nitrogen was not, "and its absence from a bitumen material can not, therefore, be regarded as unquestioned evidence of its vegetable origin; neither should the association of bitumen with boric acid be considered as a strong indication of volcanic origin for the bitumen." A shorter paper on the same subject, by the above authors, appeared in Vol. 3, pp. 403-410, of the Bulletins of the Dept. of Geology of the University of California, under the title "A Fossil Egg from Arizona." W. F. HILLEBRAND.

**Genesis of the Magnetite Deposits in Sussex County, New Jersey.** BY A. C. SPENCER. *Mining Mag.*, 10, 377–381; plate, figures. The author finds that neither the early views regarding the whole eastern magnetite field, nor the later ones of Cushing and Kemp for the Adirondack fields are acceptable for those of the highlands of New Jersey. The masses of hornblende and magnetite both originated as segregations connected with the invasion of pegmatites, but instead of being bog-ores or carbonates changed to magnetite they were apparently introduced as products of igneous activity, though not by any process of magmatic differentiation as ordinarily understood. "... it is conceived

that the accretion of certain substances, such as iron oxide, was brought about by addition of material dissolved in magmatic waters which permeated and moved through the pasty pegmatites as long as they were in an unconsolidated condition. These waters are also appealed to in explanation of deposits in limestones where there is no actual contact with pegmatite masses, and it may be that they have caused a replacement of calcite by metasomatosis."
W. F. HILLEBRAND.

**Mineral Resources of the United States, Calendar Year 1903.** 1204 pp. BY DAVID T. DAY.—In this bound volume are gathered together, as usual, the data that have been issued in the form of advance extras at frequent intervals throughout the year, several of which have been noticed in the pages of this Review.
W. F. HILLEBRAND.

## ANALYTICAL CHEMISTRY.

**The Rapid Volumetric Determination of Lime in Limestone, Cement, Lime, Blast-furnace Slags, Etc.** BY RICHARD K. MEADE. *Chem. Eng.*, 1, 20–22.—Depending on its composition the sample is to be decomposed as follows: (1) *High-grade Limestone.*—Ignite 0.5 gram in a platinum crucible for five minutes over a Bunsen burner and then for an equal time over the blast-lamp. Transfer to a beaker and heat with 40 cc. of dilute hydrochloric acid (1 : 1) until solution is complete.

(2) *Cement Rock or Hydraulic Limestone.*—Mix 0.5 gram of the sample with 0.25 gram of powdered sodium carbonate in a platinum crucible. Heat gradually to redness over a Bunsen burner, continue at this temperature for five minutes and then ignite for five minutes over the blast-lamp. Place the crucible in a beaker and decompose the sintered mass in the crucible with 40 cc. of dilute hydrochloric acid (1 : 4).

(3) *Cement.*—Pass the sample through a 100-mesh screen. Weigh out 0.5 gram, transfer to a beaker and add, with constant stirring, 20 cc. of water. With as much as possible of the cement in suspension, add 20 cc. of dilute hydrochloric acid (1 : 1) and heat until solution is complete.

(4) *Slags.*—If the sample is soluble in hydrochloric acid, weigh out 0.5 gram, stir up with a little water, add 20 cc. of the strong acid and heat until solution is complete.

To determine the lime "add dilute ammonia (sp. gr. 0.96) carefully to the solution of the sample until a slight permanent precipitate forms. Heat to boiling and add 10 cc. of a 10 per cent. solution of oxalic acid. Stir until the oxides of iron and aluminum are entirely dissolved and only a slight precipitate of calcium oxalate remains. Now add 200 cc. of boiling water and sufficient (20 cc.) of a saturated solution of ammonium oxalate to

precipitate the lime. Boil and stir for a few moments, remove from the heat, allow the precipitate to settle and filter on an 11 cm. filter. Wash the precipitate and paper ten times with hot water, using not more than 10 or 15 cc. of water each time. Remove the filter from the funnel, open and lay against the side of the beaker in which the precipitation was made, wash from the paper into the beaker with hot water, add dilute sulphuric acid, fold the paper over and allow it to remain against the wall of the beaker. Heat to 80° C. and titrate with standard permanganate until a pink color is obtained. Then drop in the filter-paper, stir until the color is discharged and finish the titration carefully drop by drop." B. S. CUSHMAN.

**Method for Analysis of Portland Cement Materials Recommended by the Committee of the Lehigh Valley Section of American Chemical Society.** *Chem. Eng.*, 1, 30–32.—This scheme of analysis was prepared from the replies received from the chemists of thirty Portland cement works to a circular letter sent out by the committee consisting of W. B. Newberry, R. K. Meade and E. B. McCready. It differs essentially from the method suggested in the Report of the Sub-committee on Uniformity in Analysis of Materials for the Portland Cement Industry (*J. Soc. Chem. Ind.*, 21, 12-30) (this Journal, R, 1902, 289), as follows:

Limestones or unburned mixtures are mixed with an equal weight of sodium carbonate before ignition over the blast-lamp. The single evaporation of the hydrochloric acid solution of the ignited substance is followed by continued heating at not above 200° C. until the odor of the acid disappears. The first precipitate of iron and aluminum hydroxides is dissolved with dilute nitric acid instead of dilute hydrochloric acid. In determining the iron the solution is reduced with powdered zinc instead of hydrogen sulphide. The lime is determined by titration with potassium permanganate after a single precipitation. Magnesium is also determined after a single precipitation. The precipitate is washed with dilute ammonium hydroxide (1 : 4) plus 100 grams of ammonium nitrate per liter, ignited at a low temperature and weighed as magnesium pyrophosphate. B. S. CUSHMAN.

**On the Assay of Tin.** BY J. H. COLLINS. *Eng. Min. J.*, 77, 928.—Several tests made by the author on samples of native tin oxide showed that nascent hydrogen reduced the "wood" tin variety to a considerable extent, while the so-called "black" tin remained nearly insoluble. The solutions were not heated during the treatment. The common method of cleaning tin ores with acids before analysis is to be condemned on account of the solubility of cassiterite under such treatment.

B. S. CUSHMAN.

**On the Assay of Tin.** *Eng. Min. J.*, 77, 957.—Under this heading the editor gives a reprint of two articles by J. S. C. Wells (*School of Mines Quart.*, 12 and 14) in which it is stated that tin ores are completely decomposed, if some pieces of platinum are present, by nascent hydrogen produced by the action of concentrated hydrochloric acid on zinc. The ores should be finely pulverized and a large excess of zinc should be used.

B. S. CUSHMAN.

**Determination of Tin in Tailings and Slimes.** BY GEORGE L. MACKENZIE. *Eng. Min. J.*, 77, 928–929.—The method employed by the author consists in cleaning the ore with aqua regia, reducing the stannic oxide to tin by ignition in an atmosphere of coal gas, dissolving out the tin with hydrochloric acid and chlorine, precipitating as stannic sulphide with hydrogen sulphide, converting the stannic sulphide to the oxide by ignition in a small weighed Berlin crucible and weighing as stannic oxide.

B. S. CUSHMAN.

**Tables to Simplify Calculation in Determining Lime Volumetrically.** *Chem. Eng.*, 1, 41–43.—These tables are to be used with permanganate solutions having an approximate strength of 0.005 gram CaO per cubic centimeter. The results may be read as CaO or as $CaCO_3$.

On account of its purity and stability, calcite, in the form of Iceland spar, should be used for standardizing permanganate solutions that are to be used for the volumetric determination of lime. Such standards are more accurate than those obtained by other methods, because the error, due to the slight solubility of calcium oxalate in hot water, is the same in standardization as in the actual determination.

B. S. CUSHMAN.

**A Simplification in Carbon Combustion Apparatus.** BY PORTER W. SHIMER. *Chem. Eng.*, 1, 23–25.—A change in the method of making carbon combustions in the Shimer crucible is thus described: "First pour finely granular, well-ignited copper oxide to a depth of $\frac{1}{8}$ inch upon the platinum disc at the bottom of the 60 cc. crucible (this Journal, 23, 227). On this, place the disc of dry asbestos and carbon, with the carbon side down. On top of this place a No. 1 porcelain crucible, cylindrical form, and press it down firmly. Put the lid on the crucible and pour fine granular copper oxide over it until the annular space between the two crucibles is filled. The copper oxide must be well ignited and freed from the finest powder by passing it over a 200-mesh sieve. The porcelain lid is now removed and a disc of ignited asbestos paper, having the diameter of the crucible at that point, and provided with a hole in the center $\frac{3}{8}$ inch in diameter, is placed on top. The rubber band is wetted and the stopper is put in place and tested for tightness. Let air sweep

rapidly through the apparatus for a minute or two, then attach the absorbent and make the combustion, using a blast-lamp surrounded by a sheet-iron cylinder open in front. For ordinary steels twenty minutes' combustion in air is sufficient. By use of oxygen this time may be reduced where highest speed is necessary. The results are fully up to standard and the copper oxide tube may be safely omitted from the chain of apparatus."

The author also gives directions for making successful combustions of organic substances in this crucible.

B. S. CUSHMAN.

**Methods for the Detection of Acetate, Cyanide and Lithium.** BY STANLEY R. BENEDICT. *Am. Chem. J.*, 32, 480–483 (1904). —The author's test for acetates, said to be applicable in presence of all strong acids and all weak acids having insoluble silver salts, is based upon two facts: (1) That silver acetate is soluble in water; and (2) that the dissociation of acetic acid is lessened by the presence of an acetate. The solution, freed from all metals except those of the alkali group, is made slightly alkaline with sodium carbonate, and is then treated with silver nitrate solution. The precipitate is filtered off, and the filtrate treated with sodium chloride solution to remove excess of silver. The solution is again filtered, and the filtrate is saturated with hydrogen sulphide. A second solution is prepared by acidifying a solution of cobaltous nitrate with a little acetic acid, and then saturating it with hydrogen sulphide. This is now added to the first solution. A heavy precipitate of cobaltous sulphide indicates the presence of an acetate in the original solution. By this means acetic acid may be detected even in a N/500 solution of its sodium salt.

The test for cyanides, applicable even in presence of sulphocyanates and ferrocyanides, is based upon the action of cyanides upon freshly precipitated oxides of mercury. The solution to be tested is made alkaline with sodium hydroxide, and is then carefully treated with a small amount of mercurous nitrate solution. A black ring of mercurous oxide is formed at the juncture of the liquids. If, when the tube is gently shaken a portion of this ring is redissolved, while the remainder becomes light gray in color, the presence of a cyanide is indicated. Hydrocyanic acid may be detected by this means in 5 cc. of a solution containing 1 part CN in 1,000,000 parts of solution.

The test for lithium depends upon the comparative insolubility of lithium phosphate in hot or cold dilute alcohol, and may be applied in presence of sodium, potassium and ammonium compounds. Lithium may be detected in a N/100 solution of lithium chloride.

A. W. BROWNE.

## METALLURGICAL CHEMISTRY.

**Chemical Characteristics of Limonite.** By F. L. Garrison. *Iron and Steel Mag.*, October, 1904.—In the Pennsylvania limonites, the phosphorus present is partly as wavellite, aluminum phosphate, and partly as vivianite, ferrous phosphate. The alumina is present partly as wavellite and partly as kaolin, aluminum silicate. The silica is present as kaolin and as grünerite, or anthosiderite, iron silicates. The iron is present mostly as limonite, partly as goethite, and some as vivianite and grünerite or anthosiderite. Some silica may be present as chloropal, and an indefinite amount as quartz sand. Ilmenite, siderite and pyrites are sometimes present, the two latter being very significant of the origin of the deposit. J. W. Richards.

**Smelting Ore by Electricity.** *Iron Trade Rev.*, November 10, 1904.—Report of Canadian Commissioners on smelting iron ores by electricity. As far as concerns American processes, it is said of the Ruthenberg process for smelting magnetite, that the process as investigated by the Commission is a failure for either agglomerating and fritting together magnetic iron ore or for any useful reduction of iron ore, and it is not probable that any modification of the process will render it a commercially profitable substitute for briquetting. J. W. Richards.

**Application of Dry Blast to the Manufacture of Iron.** By J. Gayley. *Iron Age*, October 27, 1904 (read before the Iron and Steel Institute).—The Isabella furnace of the United States Steel Corporation was provided with an ammonia refrigerating machine, which by cooling the air passing to the blowing cylinders, froze out an average of 70 per cent. of the moisture in it, cooling it to an average of 20° F. As a result of using this dried air, the blowing engines were slowed from 114 down to 96 revolutions per minute, the output of the furnace was increased from 358 to an average of 447 tons per day, and the consumption of fuel was cut down from 2,147 pounds per ton of iron made to 1,726 pounds. The temperature of the blast went up from 720° F. to 870° F., the temperature of the escaping gases fell from 538° F. to 376° F., and the percentages of $CO$ and $CO_2$ changed from 22 and 13 to 20 and 16 respectively. The refrigerating machinery absorbed some 535 horse-power, which was a little more than compensated for by the saving of power from slower running of the blowing engines, the latter amounting to 687 indicated horse-power. The drying plant was started August 21, and is now in regular operation. J. W. Richards.

**Influence of Composition on the Tensile Strength of Open-hearth Steel.** By H. H. Campbell. *Iron Age*, October 27, 1904.—(Read before the Iron and Steel Institute).—Very extensive tests were made to determine the effects of carbon, phos-

phorus, manganese, and sulphur on the tensile strength of open-hearth steel. The following formulæ were arrived at, as expressing tensile strength in pounds per square inch, carbon being determined by combustion:

Acid Steel: $40,000 + 1,000C + 1,000P + x\text{Mn} + R$.

Basic Steel: $41,500 + 770C + 1,000P + y\text{Mn} + R$.

In the above, C, P and Mn stand for each 0.01 per cent. of those elements; R stands for a variable, depending on special treatment, but being zero for ordinary air-cooled steel, while $x$ and $y$ vary numerically between 80 and 400 or 130 and 250 respectively, according as the carbon varies between 0.1 and 0.4 per cent. Tables for this variable factor of manganese are given. If carbon is determined by color, the figures are somewhat different. The paper is extensive, all details, with tables and diagrams, being given. J. W. RICHARDS.

**The Practical Handling of High Speed Steels.** BY W. B. *Iron Age*, October 6, 1904.—The chief difficulties are extreme hardness and exceeding brittleness, to overcome which proper treatment, obtained by experience is necessary. The experience gained on handling ordinary steels is of no assistance in handling the new steels; the fitness of the steel cannot be determined by a file test, nor its heat treatment be governed by the same set of color values. Hardening is best done by heating to whiteness, without access of air, and plunging into fish oil, the latter being kept cool by a cold-water jacket. Drawing the hardness is practicable, and is best done by using a pyrometer to guage the temperature, noting accurately the time, and keeping an exact record of these conditions and the results obtained. The cooling in this case is done in air. Large tools are best made of common steel, with inset cutters of the new steel.

J. W. RICHARDS.

**The Chemistry and Metallurgy of Copper, I.** BY CHARLES S. PALMER. *Eng. Min. J.*. October 20, 1904.—This is the first instalment of what is intended to be a serial publication of an extensive work on copper. We will not refer further to these papers except as they contain references to American research not heretofore published. The first paper contains some vague speculations and some weak explanations of the fundamental chemistry of the metals. J. W. RICHARDS.

**Production of Iron and Steel in 1903.** *Eng. Min. J.*, October 20, 1904.—Figures collected for Vol. XII. of the Mineral Industry make the total production of pig-iron in the world, in 1903, 46,733,037 tons, of which 18,297,400 tons, or 38.9 per cent., was made in the United States. The total steel production was 35,368,257 tons, of which 14,768,593 tons, or 41.8 per cent., was made in the United States. Wrought-iron is made in Great

Britain to a larger extent than in any other country. Over three-quarters of all the pig-iron made is converted into steel.

J. W. RICHARDS.

**The Classification of Iron and Steel.** BY A. SAUVEUR. *Iron and Steel Mag.*, August, 1904 (read before the American Society for Testing Materials).—The two main classes suggested are: (1) Iron obtained in a molten condition and therefore free from slag; (2) Iron obtained in a pasty condition and therefore containing intermingled slag. The class 1 is divided into (*a*) not malleable, including cast iron, and (*b*) malleable, including steel and malleable cast-iron. Class 2 is divided into (*a*) wrought-iron, with carbon under 0.25 per cent. (*b*) steely wrought iron, with carbon over 0.25 per cent., and (*c*) cemented or blister steel. The scheme is good as classification, but introduces no new nomenclature except *steely wrought-iron*.

J. W. RICHARDS.

**Pyritic Smelting.** BY G. F. BEARDSLEY. *Eng. Min. J.*, October 13, 1904.—A discussion of alumina in the slags formed in such smelting. In all cases the furnace forms the most easily fusible slag from the materials fed into the zone of fusion. In many cases the slag is a low-melting iron silicate; lime added to this lowers its fusibility; alumina, beyond small limits, increases its viscosity and melting-point. If the alumina is present in the charge as natural bi- or trisilicates the temperature is not high enough to break these up, and they simply dissolve up to a certain limit in the fusible slag formed; if there is more aluminum silicate present than can be thus dissolved, the furnace freezes up. The working limit of alumina is ordinarily 7 per cent., although it may be forced up to 8 or 9 per cent. J. W. RICHARDS.

**The Zinc Ores of Virginia.** BY C. Q. PAYNE. *Eng. Min. J.*, October 6, 1904.—The calamine is overlaid by clay containing zinc sulphide very intimately mixed, and from which the zinc has been probably leached by hot silicious waters. These are similar to the buck-fat and tallow clays of Missouri. They average only 20 per cent. of zinc, which is increased to 25 per cent. by calcination, and which can be brought to 30 or 35 per cent. by careful washing out of sand and iron oxide. The final concentrate is too low, however, to be retorted alone and must be mixed with high-grade ore to be worked. A cheaper process of working this zinciferous clay is greatly needed, since thousands of tons of zinc have been thrown away as tailings in this form.

J. W. RICHARDS.

**Condition of the Mercury Industry in Texas.** BY W. B. PHILLIPS. *Eng. Min. J.*, October 6, 1904.—Two companies are now producing in the Terlingua district, Brewster County, working mostly from deeper cuttings than before. The ore continues

steadily in depth, some terlinguaite (an oxychloride of mercury) being found in considerable quantity. A new 50-ton Scott furnace is being erected. The chief difficulty is the lack of fuel, wood costing $6 per cord delivered. Mexican labor costs 90 cents to $1.25 per day. J. W. RICHARDS.

**Chlorination in Colorado.** BY W. E. GREENWALT. *Eng. Min. J.*, October 27, 1904.—Of the 60,000 tons of ore mined monthly in the Cripple Creek district, 40,000 tons are treated by chlorination, 9,000 tons by cyaniding and 11,000 tons by smelting. Of that cyanided one-third is first roasted, two-thirds is treated raw; the former is high-grade, the latter low-grade. If the ore has to be roasted chlorination is as cheap as cyanidation; when the chlorine is electrolytically generated it is by far the cheaper process. Five years ago over half the ore was smelted, now smelting treats barely one-sixth. The barrel chlorination process represents the best practice; the mills have a daily capacity of 1,500 tons. The ore runs $15 to $100 in gold per ton, the average $20 to $30; silver one-quarter to one-half ounce; sulphur 1.5 to 3 per cent. The total cost of treatment by chlorination is $2.75 to $3.50 per ton, and the extraction is 90 to 95 per cent.; high tellurium ore gives the purest extraction. The ore is sampled, bedded in lots of 3,000 to 4,000 tons, crushed to 12 mesh, and roasted in chain-driven, straight-line Wethey furnaces, or in Pearce turret furnaces, until the sulphur is 0.25 to 0.85 per cent., 60 to 100 tons being roasted per furnace per twenty-four hours, using 10 to 15 tons of bituminous coal per 100 tons of ore. The roasting temperature is not above 930° C. The cost of roasting is 40 to 50 cents per ton. The barrel charge is usually 20,000 pounds of ore, 10,000 pounds of water, 200 to 400 pounds of 66° sulphuric acid and 100 to 200 pounds of bleaching powder, carrying 33.5 per cent. of chlorine. The barrel shell is steel, lining, sheet lead. The chlorination lasts two and a half to four hours, the barrels revolving 3.5 to 4.5 revolutions per minute. The barrels have a filter on one side, through which the liquid can be drained off in two and a half to four hours. One ton of ore makes about 1 ton of solution. Water at 25 to 50 pound pressure is used for washing. The solution stands twenty-four hours to settle clear. The precipitation vats hold 75 to 100 tons of solution, which is precipitated by hydrogen sulphide, most of which is used in forming hydrochloric acid with the chlorine present. One pound of iron sulphide, 2.5 pounds of sulphuric acid with 6 pounds of water, generate enough gas to precipitate the gold from 1.5 tons of solution. Precipitation is complete, copper and lead would also be precipitated, but they are not present in the ores. The gas is stopped the minute all the gold is precipitated, because an excess will cause sulphur to precipitate. The gas is introduced through perforated lead pipes. The solution is decanted

off, and when a sufficient number of vat-fuls have been precipitated the gold is pumped into filter presses, the resulting cakes dried by air-blasts, roasted in small muffle furnaces and then melted to bullion. The costs of the whole process per ton of ore are: Sampling, coarse crushing and bedding, 30 cents; fine crushing, 35 cents; roasting, 45 cents; chlorinating, 90 cents; precipitating, 10 cents; other general expenses, 80 cents; total $2.90. The barrel tailings are concentrated to save the coarse gold, at a ratio of 75 or 100 to 1, saving about 20 per cent. of the gold in the tailings; the concentrate is sold to the smelters.

J. W. RICHARDS.

**Chlorination vs. Cyanidation.** BY P. ARGALL. *Eng. Min. J.*, November 24, 1904.—The writer strongly opposes the statements of Mr. Greenawalt (see preceding abstract) that chlorination is cheaper than cyaniding, claims that chlorination costs much more than the $2.95 per ton stated by Mr. Greenawalt, and states that the cyanide process is cheaper, and will soon displace chlorination of these ores. J. W. RICHARDS.

**Fine Gold.** *Eng. Min. J.*, November 24, 1904.—Three bars of gold, valued at $45,100 recently received from the camp at Goldfields, Nev., assayed respectively 987.5, 987.5 and 981 fine. Such gold is unusually high-grade, and is worth $20.41 per ounce.

J. W. RICHARDS.

**Tin in the United States.** BY F. L. GARRISON. *Eng. Min J.*, November 24, 1904.—A sketch of the tin ore localities in California, the Black Hills, Virginia, South Carolina and Alaska. There are probably in all of these localities tin ores which are as rich as, or richer than, the ores of Europe, of the Altenberg district in Saxony, for instance; and the failures of the American mines have been largely due to ignorance of the best manner of working the ore. It is probable that the high price of tin will lead to renewed activity in the mining of tin ore in America.

J. W. RICHARDS.

**Tungsten: Its Use and Value.** *Eng. Min. J.*, November 10, 1904.—The annual production in the United States is 3,000 to 5,000 tons of crude ore, yielding 200 to 350 tons of concentrate carrying 50 to 65 per cent. of tungstic acid, valued at $7 per unit of tungstic acid, per ton, at New York. Metallic tungsten, 90 per cent. pure, made in the electric furnace, sells at $1.25 per pound, and ferro-tungsten, 37 per cent., at 45 cents per pound.

J. W. RICHARDS.

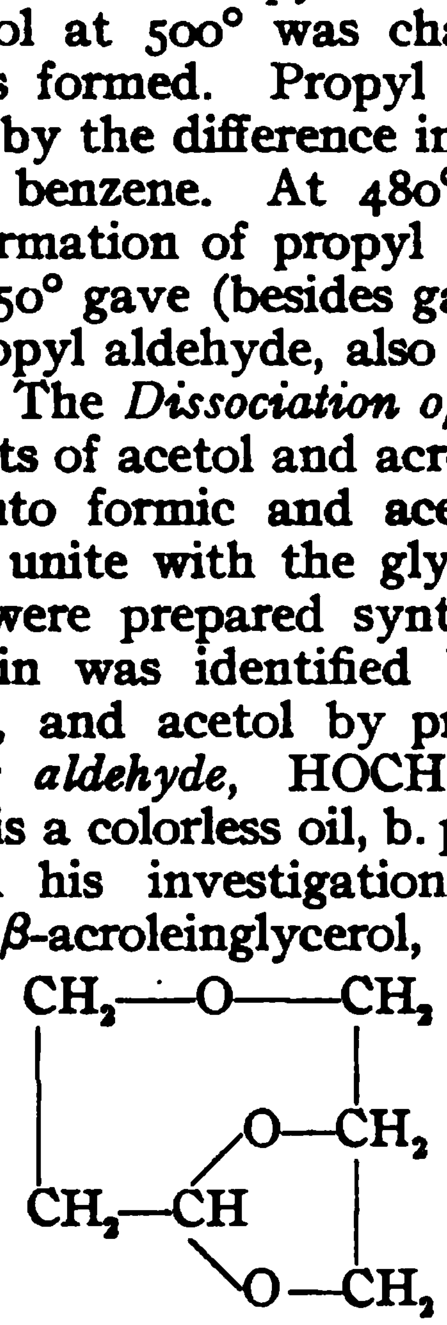
**The Chemistry of Electroplating.** BY W. D. BANCROFT. *Electrochem. Ind.*, October, 1904.—A "good" deposit may be good from the point of view of the analyst, the refiner or the plater; the analyst must have a deposit of pure metal in a weigh-

able form, the refiner wants a coherent deposit of pure metal, the plater must have an adherent smooth deposit which will burnish to a smooth, even surface. There is much evidence that a metallic deposit is improved by adding to the solution substances which will dissolve the oxide, hydroxide or basic salts of the metal. In many cases the addition of a reducing agent improves the quality of the deposit, but we do not know definitely how much influence it has under certain conditions; in some cases it acts detrimentally. Regarding current densities used, the more active the stirring the higher density of current may be used; the occurrence of dilute solution at the cathode causes sandy or black powdery deposits, or even the formation of an oxide or a basic salt. Hydrogen may be the cause of a bad deposit; trouble from this source can often be remedied by adding an oxidizing agent to the solution. The deposit is more coarsely crystalline the lower the current density and the higher the temperature, and the more concentrated the solution. The deposit is more finely crystalline the greater the solvent action of the solution upon it. The addition of glue or a similar substance tends to make deposits come down in finer crystals. The surface of adhesion is a surface where true alloying takes place, the two metals uniting to form solid solutions in each other. J. W. RICHARDS.

## ORGANIC CHEMISTRY.

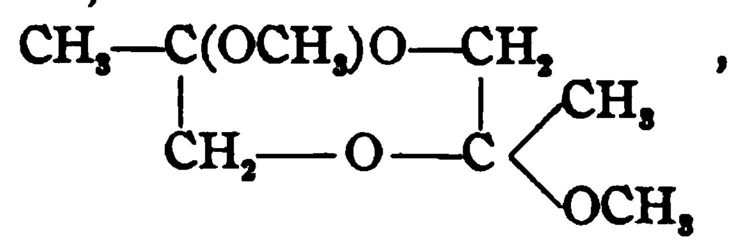
**Dissociation Processes in the Glycol-Glycerin Series.** BY J. U. NEF. *Ann. Chem.* (Liebig), 335, 191–333.—Primary or secondary alkyl or aryl halides, and the corresponding alcohols always undergo an alkylidene and never an olefine dissociation. Later investigations now show that the same holds true in the case of polyatomic compounds. When a primary or secondary alcohol is heated to its dissociation point two mutually independent reactions occur. (1) The alkylidene decomposes the separated water with formation of alkylidene oxide and nascent hydrogen, which latter, according to circumstances, may change to molecular hydrogen or serve to reduce unsaturated substances present, $R_2CHOH \rightarrow R_2C : + H_2O \rightarrow R_2CO + H_2$. (2) The alkylidene polymerizes, $R_2C : \rightarrow R_2C : CR_2$, or rearranges to an olefine. PART I. *Dissociation of the Glycols and of Glycerol.*—The dissociation of the glycols and of glycerol at high temperatures may give first an alkylidene oxide, which rearranges to an alkylene oxide, the dissociation of the latter giving rise to the various products observed. Thus glycol yields first oxyethylidene, $HOCH_2CH :$, which changes to ethylene oxide, $\overline{O.CH_2.CH_2}$, the dissociation of the latter giving acetaldehyde, as shown by Ipatiew. At higher temperatures glycols may yield directly similar products without the intermediate formation of any alkylene oxide. In

similar manner glycerol may pass direct, without the intermediate formation of any glycid, to acetol and hydracrylic aldehyde (or acrolein). *Ethylene Oxide and Ethylene Glycol.*—The former changed into acetaldehyde when heated at 400°-420°. Glycol was unchanged at 400°, but at 500°-550° gave acetaldehyde and its decomposition products. *Propylene Glycol and Propylene Oxide.*—Propylene glycol at 500° was changed to propyl aldehyde. No acetone was formed. Propyl aldehyde and acetone can be easily separated by the difference in the solubility of their semicarbazones in hot benzene. At 480°-505° propylene oxide was dissociated with formation of propyl aldehyde and acetone. *Trimethylene glycol* at 450° gave (besides gas) a mixture of much acrolein with a little propyl aldehyde, also small amounts of allyl and *n*-propyl alcohols. The *Dissociation of glycerol* at 450° gave first about equal amounts of acetol and acrolein, the acetol partly decomposing further into formic and acetic aldehydes. These aldehydes may in turn unite with the glycerol to aldehyde glycerols, and the latter were prepared synthetically for purposes of comparison. Acrolein was identified by conversion to pyrazoline-*N*-carbonamide, and acetol by preparation of its semicarbazone. *Hydracrylic aldehyde*, $HOCH_2CH_2COH$, from acrolein and water at 100°, is a colorless oil, b. p. 90° at 18 mm. The author concludes, from his investigations, that *Glycerol ether* must be identical with *β*-acroleinglycerol,



*Dissociation Experiments in the Glycid Series.*—Glycid can be easily obtained by the action of the calculated amount of alcoholic potassium hydroxide or sodium ethylate upon *α*-chlorhydrin. The dissociation of glycid or of its derivatives at 450° led to the formation of acetol or of a derivative of acetol. *Epiiodhydrin* was prepared by boiling an absolute alcohol solution of epichlorhydrin with potassium iodide, precipitating with water, collecting the oil in ether, shaking the ether solution with dilute sodium hydroxide and fractioning, b. p. 62° at 24 mm. Heated with silver oxide it gave *diglycid ether*, $(\overline{O.CH_2.CH}.CH_2)_2O$, colorless oil, b. p. 103° at 22 mm. When the latter was heated with water at 100° it changed to *dioxypropyloxide*, $(HOCH_2CHOHCH_2)_2O$, b. p. 261°-262° at 27 mm.; at 440°-450° some acetic and crotonic aldehydes were formed. *Glycid ethyl ether*, from *α*-chlorhydrin ethyl ether and sodium hydroxide, dissociated at 450°, gave acetaldehyde and acetol ethyl ether. PART II. *Preparation and*

*Properties of Acetol.*—Acetol is best prepared by heating for ten hours a methyl alcohol solution of chlor- or bromacetone with 1.5 molecules of anhydrous potassium or sodium formate. Acetol dissociates as follows: (A) $CH_3COCH_2OH \rightarrow CH_3COH + :CHOH$, and (B) $CH_3COCH_2OH \rightarrow CH_3COCH: + H_2O$. Dissociation according to (A) is shown in the experiments with glycerol, and also in the fact that acetol at 450° gives much acetaldehyde and metaformaldehyde, together with a little crotonic aldehyde. The number of B-molecules present in acetol can be increased by the presence of alkalies, which cause the formation of salts, $CH_3COCH_2OMe$, which have lower dissociation points than the free alcohol. This explains the fact that in many of the decompositions of acetol, and also of the corresponding halogen acetones, $CH_3COCH_2X$, the intermediate formation of acetylmethylene must be assumed. *Acetolphenylhydrazone*, colorless four-sided needles, m. p. 106°. *Acetolosazone*, $C_{15}H_{16}N_4$, m. p. 154°. *Bis-Acetolmethylalcoholate*,



colorless monoclinic crystals, m. p. 127°, b. p. 193°-194°. Identical with the "diacetolether" of Henry. *Acetoloxime*, m. p. 68°-70°, b. p. 123°-125° at 18 mm. Bromacetone was prepared by the rapid addition of bromine to a mixture of acetone, water and acetic acid at 70°; b. p. 38°-46° at 13 mm., sp. gr. 1.634 at 23°. *Acetol acetate*, from bromacetone, potassium acetate and methyl alcohol at 100°, at 430°-445° gave partly acetaldehyde, crotonic aldehyde and acetic acid. Its *semicarbazone* forms needles, m. p. 145°. *β-Brompropionic aldehyde*, prepared from its acetal, boils at 40°-45° at 18 mm. *d-α-Brompropionic aldehyde*, prepared by brominating propionic aldehyde, boils at 42°-44° at 63 mm., sp. gr. 1.523 at 21°; attacks the eyes violently. With water or alcohol it forms the hydrate or alcoholate, but if heated with sodium formate and methyl alcohol yields acetol. *d-α-Iodpropionic aldehyde*, from the corresponding bromaldehyde and potassium iodide, boils at 40° at 15 mm.; heated with silver acetate and absolute alcohol at 100° it gave *d-lactic aldehyde acetate*, $C_5H_8O_3$, as an oil of aromatic odor, b. p. 52°-55° at 15 mm.; heated with water at 190° it broke up into acetol and acetic acid. *d-Lactic aldehyde semicarbazone*, $C_6H_{11}O_3N_3$, transparent needles, m. p. 163°. *The Behavior of Acetol and of Benzoylcarbinol towards Fehling Solution and Other Oxidizing Agents.*—Oxidation of acetol or of benzoylcarbinol with copper hydroxide and sodium hydroxide gave *d*-lactic and *d*-mandelic acids. Copper sulphate or acetate may also be used as oxidizing agents. In the case of benzoylcarbinol benzoylformaldehyde was separated as the intermediate product, this passing by a simple benzilic

acid rearrangement into *d*-mandelic acid, $C_6H_5COCH_2OH \rightarrow C_6H_5COCOH + H_2O \rightarrow C_6H_5CHOHCOOH$. Stronger oxidation of acetol broke it up into acetic acid and carbon dioxide (or formic acid). PART III. *The Behavior of Glycols and of Glycerol towards Caustic Alkalies and Oxidizing Agents. Dissociation of Monosodium Glycerol.*—Monosodium glycerol begins to dissociate at 250°. The products of dissociation at 270°-280° were found to be mainly *d*-lactic and propionic acids, with hydrogen, methyl alcohol, small amounts of *n*-propyl and allyl alcohols, and formic, carbonic and oxalic acids. By the action of *p*-nitrobenzoyl chloride upon the sodium glycerol the following were obtained: *p-trinitrobenzoylglycerol*, $C_{24}H_{17}O_{12}N_3$, colorless needles, m. p. 192°; and *p-dinitrobenzoylglycerol*, $C_{17}H_{14}O_9N_2$, m. p. 137°. *Dissociation of d-Lactic Acid and Its Behavior towards Potash Lime or Excess of Sodium Hydroxide.*—At 440°-460° *d*-lactic acid dissociates into the following: $CH_3CHOHCOOH \rightarrow CH_3COH + HCOOH$. The salts of lactic acid, however, dissociate rather differently, $CH_3CHOHCOOM \rightarrow CH_3\ddot{C}COOM + H_2O$. Thus calcium lactate heated alone at 240° gave the calcium salt of dilactic acid, $CH_3(COOM)C{:} + HOCH(COOM)CH_3 = CH_3(COOM)CH.O.CH(COOM)CH_3$. In presence of excess of potassium hydroxide the lactic salts gave mainly carbon dioxide and propionic acid. *Glycerol*, heated with potash-lime at 270°-325° gave the same products, with intermediate formation of formic, oxalic and *d*-lactic acids. *Pyruvic acid*, heated with solid caustic alkali at 250°-270° gave carbon dioxide, with small amounts of acetic and propionic acids. *Propylene glycol*, under similar conditions, yields, beside propyl alcohol, also *d*-lactic aldehyde and acetol, which may further break down into methyl and ethyl alcohols, lactic and propionic acids. *Trimethylene glycol* decomposes at 150° with evolution of hydrogen and formation of hydracrylic aldehyde, the latter then breaking up into acetic and formic aldehydes. *Ethylene glycol* heated with 1 molecule of sodium hydroxide at 230°-284° gave mainly di- and triethylene glycol and glycollic acid with methyl and ethyl alcohols, and smaller amounts of carbon dioxide, acetic and oxalic acids. *Behavior of Glycols and Glycerol towards Oxidizing Agents.*—Propylene glycol on oxidation yields the same products as acetol. By heating glycerol with precipitated mercuric oxide in presence of barium oxide formic and glyceric acids were obtained; with sodium hydroxide solution and silver chloride, or with silver oxide, formic and glycollic acids resulted; with potassium permanganate the products were oxalic acid and carbon dioxide. The author found that *d*-glyceric aldehyde, *d*-glucose, *d*-fructose, and all other hexoses, when treated with one and a half parts of sodium hydroxide at 40°-50° gave the same products, *viz.*, *d*-lactic and erythritic acids. *d*-Glyceric aldehyde with copper hydroxide and sodium hydroxide readily passed into *d*-glyceric acid, while the hexoses, under similar conditions, gave

preferably erythritic acid. Hexoses, *e. g.*, glucose, treated at 70°-100° with aqueous copper acetate separated cuprous oxide and gave the glucosone, the corresponding ketonic acid, *d*-arabinose, *d*-erythrose and *d*-erythritic acid. M. T. BOGERT.

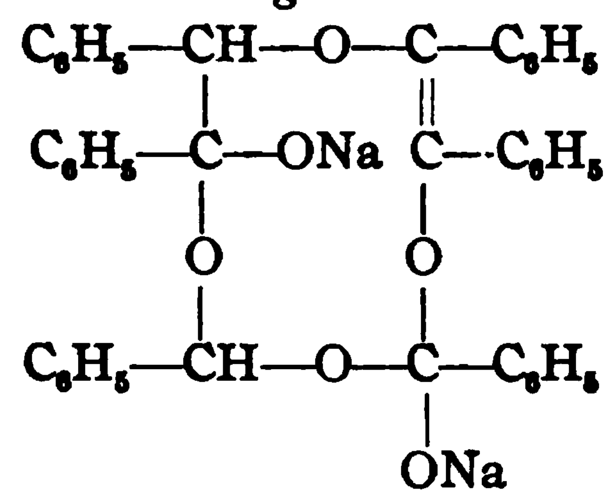
**On Triphenylmethyl (Tenth Paper).** BY M. GOMBERG AND L. H. CONE. *Ber. d. chem. Ges.*, 37, 3538–3547.—This paper includes the authors' recent and more extensive investigations on the action of oxygen upon triphenylmethyl and the behavior of the resultant peroxide with various reagents; also, certain preliminary communications concerning the action of light upon triphenylmethyl. EXPERIMENTAL. I. *Oxidation of Triphenylmethyl.*—Atmospheric oxygen changes triphenylmethyl to the peroxide, probably according to the following reaction: $2(C_6H_5)_3C + O_2 = (C_6H_5)_3C.O.O.C(C_6H_5)_3$. To ascertain the correctness of this equation the authors determined the amount of oxygen absorbed by a known weight of triphenylmethyl, and also the weight of peroxide formed when a definite amount of triphenylmethyl in solution was exposed to the action of oxygen. *Absorption of Oxygen.*—Benzene, toluene and nitrobenzene were used as solvents for the triphenylmethyl, and the amount of oxygen absorbed by a known weight of the hydrocarbon was determined. The above equation calls for 6.59 per cent. of oxygen. The results obtained in the various experiments approached this very closely. Thus, in toluene solution, the oxygen absorbed varied from 6.37 to 6.65 per cent. *Weighing the Peroxide.*—The amount of peroxide obtained was always less than the theoretical. When the peroxide was prepared with pure oxygen and the solution allowed to evaporate in oxygen the yield was only 63 to 69.5 per cent. of the theory, while when air was used it rose as high as 80.3 to 86.6 per cent. The loss in peroxide is believed to be due to the further oxidation and decomposition of the peroxide first formed, with production of oily bodies soluble in ether. *Heat of Formation of the Peroxide.*—The formation of the peroxide is accompanied by rise of temperature, but the heat of formation could not be exactly determined under the conditions of the experiment. II. *Reactions of Triphenylmethyl Peroxide.*—Sulphuric acid converts the peroxide into triphenylcarbinol. Both the peroxide and the carbinol dissolve in sulphuric acid with a deep red color. *Triphenylmethyl sulphate* was prepared from triphenylchlormethane and silver sulphate in liquid sulphur dioxide solution. The sulphate is very dark red and gives intense red solutions. The latter are decolorized slowly in presence of moisture from hydrolysis of the sulphate to the carbinol and sulphuric acid. *Behavior of the Peroxide towards Halogens.*—If the peroxide is suspended in chloroform and treated with excess of bromine dark red crystalline triphenylbrommethanepentabromide is obtained with evolution of considerable heat.

It is very unstable and readily loses bromine. If the peroxide is suspended in carbon tetrachloride, 1 molecule of bromine added and the mixture heated on the water-bath, triphenylmethylbromide is formed. If the peroxide is suspended in chloroform and bromine and iodine added various products result; if the iodine is in considerable excess, triphenylbrommethanepentaiodide is formed. Chlorine acts upon the peroxide only in the presence of a halogen carrier. Suspended in boiling carbon tetrachloride with a little iodine and treated with a stream of chlorine triphenylmethylchloride was produced, together with some benzophenonechloride, while among the products of the hydrolysis of the crude mixture there was found a small amount of what was probably 2,4'-dichlorbenzophenone. *Action of Phosphorus Pentachloride.*—When the peroxide was heated at 125°-135° with phosphorus pentachloride the products were benzophenone chloride and diphenylenephenylmethane. The authors believe that triphenylmethylchloride is one of the first products in this reaction, since by the action of phosphorus oxychloride upon it considerable diphenylenephenylmethane is formed. III. *Action of Light upon Triphenylmethyl.*—The spontaneous changes of triphenylmethyl and its analogues in solutions protected from the air, accompanied by loss of color and of unsaturated character, and formerly ascribed to polymerization, are now shown to be due to the action of light. Strong solutions of triphenylmethyl in benzene or carbon tetrachloride are decomposed in a few hours by direct sunlight, with the formation of various products, among which triphenylmethane was noted, but not hexaphenylethane. M. T. BOGERT.

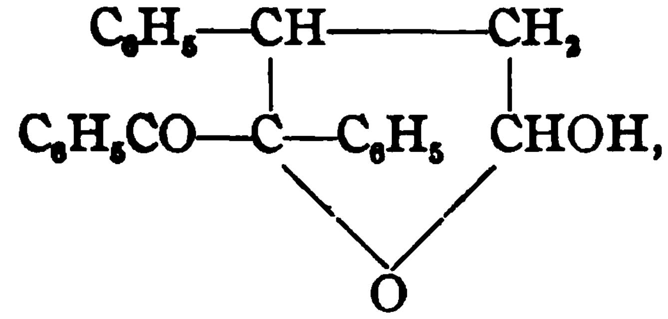
**Modern Hypnotics.** BY V. COBLENTZ. *Therapeutic Gazette*, May 15, 1904, pp. 298 *et seq.*—A review of certain synthetic organic hypnotics, with brief statements as to the therapeutic value, dose, etc. The substances discussed are the following: Chloral hydrate, butyl chloral hydrate, paraldehyde, amylene hydrate, chloralamide, chloral ammonium, chloralimide, chloralides, chloralose, dormiol, chloretone, isopral, sulphonals, urethane, hedonal and veronal. M. T. BOGERT.

**Some Reactions of Benzoin.** BY J. B. GARNER. *Am. Chem. J.*, 32, 583–606.—The paper deals with the reaction between benzoin and alcoholic solutions of sodium ethylate, a study of which was undertaken for the following purposes: (1) To establish the composition and constitution of the crystalline substances, observed by Päpcke, which results when absolute ethyl alcoholic solutions of benzoin and sodium ethylate are brought together at 25°; and (2) to determine quantitatively the exact nature of the reactions which take place when benzoin is treated with solutions of sodium ethylate in ethyl alcohol, (*a*) of 92 per cent., as formerly carried out by Jena and Limpricht; and (*b*) absolute;

a comparison of the results obtained might then lead to an interpretation of the reactions involved. EXPERIMENTAL. I. *Benzoin and Sodium Ethylate at* 25°, in absolute alcoholic solution, react to form a substance, crystallizing in long, white, silky needles, to which the following formula is assigned:



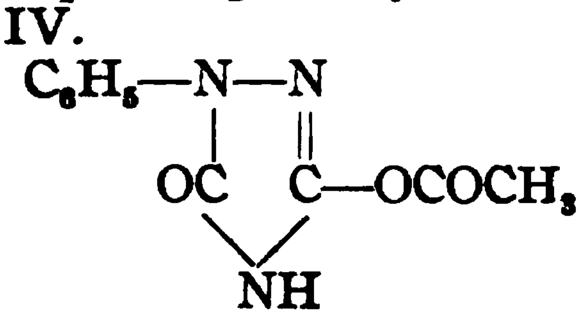
It appears to be stable only in cold absolute alcohol or absolute ether. With water at 20° it decomposes into benzoin, benzoic acid and sodium hydroxide. II. *Benzoin with Sodium Ethylate.*—When the reaction was carried out in 92 per cent. alcohol the products were ethylbenzoin, hydrobenzoin, isohydrobenzoin, and their dimolecular anhydrides, benzoic acid, benzilic acid, ethyl benzilic acid and benzyl alcohol. When the reaction was conducted in absolute alcohol, in addition to the above products, $\alpha$-benzoyl-$\alpha$-phenyl-$\alpha'$-oxy-$\beta$-phenyltetrahydrofurfurane was obtained. When benzoin and sodium ethylate were dissolved in absolute alcohol and a stream of dry oxygen passed through the boiling solution for twenty-three hours the products were the tetrahydrofurfurane derivative, benzaldehyde, benzoic acid and traces of benzilic acid. The following facts were also established: (1) The "ethylbenzoin" of Jena and Limpricht is a mixture of hydrobenzoin, isohydrobenzoin, and their dimolecular anhydrides. (2) The "isodesoxybenzoinpinacone" of Jena and Limpricht is a mixture of ethylbenzoin, isohydrobenzoin and its dimolecular anhydride. (3) The "ethyldibenzoin" of Jena, Limpricht and Schwanert, Jena and Limpricht, and Japp and Owen, is $\alpha$-benzoyl-$\alpha$-phenyl-$\alpha'$-oxy-$\beta$-phenyltetrahydrofurfurane. (4) The substance to which Jena and Limpricht assigned the formula $C_{28}H_{24}O$ is the dimolecular anhydride of isohydrobenzoin in an impure form. *$\alpha$-Benzoyl-$\alpha$-phenyl-$\alpha'$-oxy-$\beta$-phenyltetrahydrofurfurane*,.

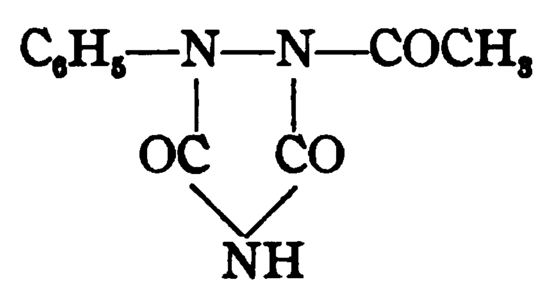


melts at 195°. It is soluble in alcoholic, but not in aqueous, alkalies, and is reprecipitated by acids. In presence of air, ethyl

alcohol, saturated with hydrochloric acid gas, converts it partly into benzil and ethyl cinnamate. Chromic acid oxidizes it to benzoic acid and carbon dioxide; alkaline permanganate or nitric acid oxidizes it to $\beta$-$\gamma$-diphenyl-$\gamma$-benzoylbutyrolactone, m.p. 138.5°. By the action of acetyl chloride, or of acetic anhydride and fused sodium acetate, upon the furfurane compound, a *monacetyl derivative* was obtained, crystallizing from alcohol in large transparent plates, m. p. 145°. Fusion of the tetrahydrofurfurane derivative with solid potassium hydroxide gave benzoic, cinnamic and some acetic acid. The same tetrahydrofurfurane derivative was obtained by the direct addition of benzoin to cinnamic aldehyde under the influence of a dilute absolute alcoholic solution of sodium ethylate. M. T. BOGERT.

**On the Acetyl Derivatives of Phenylurazole.** BY S. F. ACREE. *Am. Chem. J.*, 32, 606–611.—A sample of phenylacetylurazole was prepared by the Cuneo method. It melted at 173° and was apparently perfectly pure. Treated with diazomethane, a 1-phenyl-4-methylacetylurazole was obtained melting at 94°, but the same sample of phenylacetylurazole, after standing for a few months, was treated with diazomethane under the same conditions as before, and then gave only a higher melting isomer (m. p. 113°-115°), identical with Busch's 1-phenyl-4-methylacetylurazole. The lower melting isomer (m. p. 94°) readily rearranged to the higher melting one (m. p. 113°-115°) on melting. No change could be detected in the sample of phenylacetylurazole to account for this change in behavior. At the time a second sample of phenylacetylurazole was prepared and showed the same peculiar behavior. Since then, however, all attempts by the author to prepare other lots of phenylacetylurazole which would yield the low melting methyl derivative have failed. In every case the product obtained by the action of diazomethane was the higher melting isomer. The first samples of phenylacetylurazole prepared, the author believes, must have been of a labile form, probably best expressed by Formula I, which passed spontaneously into the more stable form represented by Formula II. The corresponding methyl derivatives are illustrated by Formulas III and IV.


I.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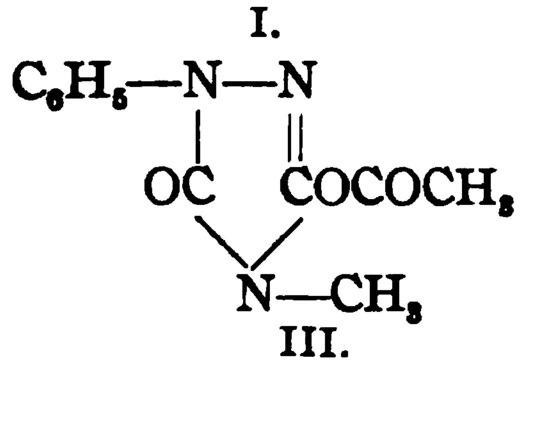
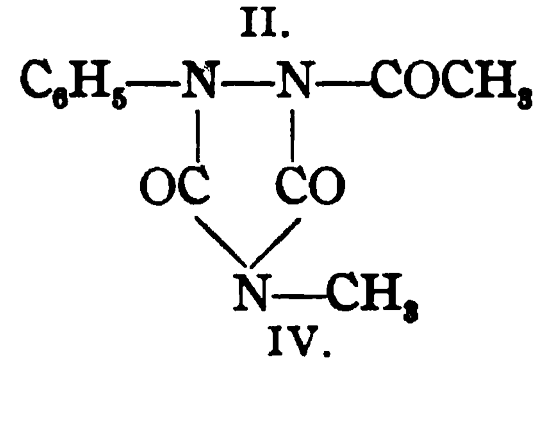
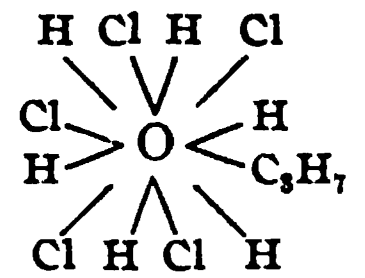

III.


IV.

The author always finds phenylacetylurazole to be the chief product of the action of acetyl chloride upon silver phenylurazole with a small amount of phenyldiacetylurazole, m. p. 165°. Wheeler and Johnson describe the sole reaction-product as a labile phenyldiacetylurazole. The formation of this substance the author has never observed. Wheeler and Johnson also state that, by the action of ethyl iodide on silver phenylurazole, they obtained 1-phenyl-3,5-diethoxyurazole and phenylurazole, but no 1-phenyl-3-ethoxyurazole. According to the author's experience, the latter is the chief product of the reaction, and he explains why Wheeler and Johnson failed to find it. M. T. BOGERT.

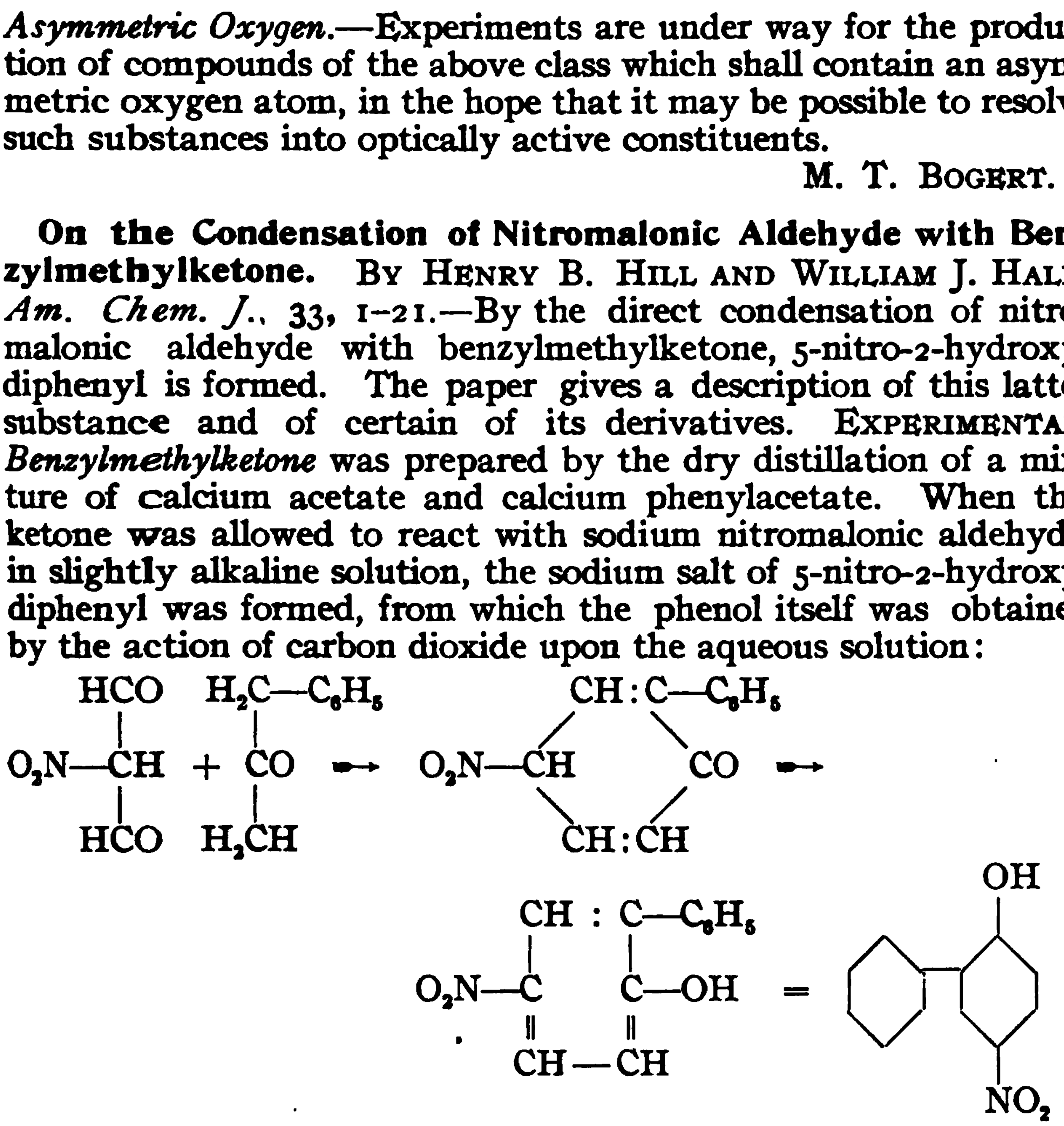
**The Basic Properties of Oxygen. Additive Compounds of the Halogen Acids and Organic Substances and the Higher Valencies of Oxygen. Asymmetric Oxygen.** BY EBENEZER HENRY ARCHIBALD AND DOUGLAS McINTOSH. *J. Chem. Soc.* (London), 85, 919–930.—The compounds described are those obtained by the interaction of the liquid halogen hydrides with ketones, ethers and alcohols at very low temperatures. *The Basic Properties of Oxygen.*—Definite compounds were obtained of hydrogen iodide with ethyl ether, methyl amyl ether, phenylmethyl ether, acetone, ethyl and propyl alcohols. Similar compounds were obtained with hydrogen bromide, except in the case of ethyl alcohol, and with hydrogen chloride, except in the case of the two alcohols. All these compounds were colorless crystalline substances, of sharp melting-points, nearly always well above the melting-points of the reacting substances. They readily formed supersaturated solutions in the acids from which they were prepared, from which solutions they could be easily precipitated by the addition of a few crystals. EXPERIMENTAL.—The additive compounds soon commenced to separate when the organic liquid, at a temperature of —80°, was added to the liquid hydrogen halide. By allowing the temperature to rise somewhat, the additive compound dissolved in the excess of acid present, and was then thrown out in crystals by again reducing the temperature. The crystals were dried by aspiration in a specially constructed apparatus, in which the temperature could be reduced to —103° if necessary. *Acetone Compounds.*—$((CH_3)_2CO)_2,HI$, m. p. —18°, soluble both in acid and in acetone; $(CH_3)_2CO,HBr$, m. p. —9°, is unstable in the liquid form; $((CH_3)_2CO)_2,5HCl$, m. p. about —85°. *Ether Compounds.*—$(C_2H_5)_2O,HI$, m. p. —18°; $(C_2H_5)_2O,HBr$, m. p. —40°; $(C_2H_5)_2O,5HCl$, m. p. about —92°; $(CH_3)_2O,5HCl$, m. p. —120° (?). *Alcohol Compounds.*—$C_3H_7OH,2HI$, m. p. about —65°; $C_3H_7OH,2HBr$, m. p. —85° (?); $C_3H_7OH,5HCl$, m. p. —120° (?). Constitutional formulas are given for the above, assuming that oxygen possesses a valency ranging from four to twelve, the valency being influenced by the temperature. Thus, for the compound $C_3H_7OH,5HCl$, the following structure is suggested:



*Asymmetric Oxygen.*—Experiments are under way for the production of compounds of the above class which shall contain an asymmetric oxygen atom, in the hope that it may be possible to resolve such substances into optically active constituents.

M. T. BOGERT.

**On the Condensation of Nitromalonic Aldehyde with Benzylmethylketone.** BY HENRY B. HILL AND WILLIAM J. HALE. *Am. Chem. J.*, 33, 1–21.—By the direct condensation of nitromalonic aldehyde with benzylmethylketone, 5-nitro-2-hydroxydiphenyl is formed. The paper gives a description of this latter substance and of certain of its derivatives. EXPERIMENTAL. *Benzylmethylketone* was prepared by the dry distillation of a mixture of calcium acetate and calcium phenylacetate. When this ketone was allowed to react with sodium nitromalonic aldehyde, in slightly alkaline solution, the sodium salt of 5-nitro-2-hydroxydiphenyl was formed, from which the phenol itself was obtained by the action of carbon dioxide upon the aqueous solution:



5-*Nitro-2-hydroxydiphenyl* crystallizes from dilute acetic acid in long, yellow needles, m. p. 125°-126° (corr.), readily soluble in acetone or alcohol, sparingly soluble in boiling water. It sublimes in yellow needles. Its *sodium salt* crystallizes from water in beautiful orange-red prisms, containing 3.5 molecules of water, upon losing which the salt turns crimson. Its *methyl ether*, from the sodium salt and methyl iodide, crystallizes from alcohol in colorless needles, m. p. 95.2° (corr.). Oxidation of this methyl ether, with chromic acid in acetic acid solution, gave benzoic acid and the methyl ether of 5-nitrosalicylic acid, thus establishing its structure. The *ethyl ether* closely resembles the methyl ether, and melts at 110.6° (corr.). The *benzoic ester*, $C_6H_5.C_6H_3(NO_2)(OCOC_6H_5)$, crystallizes from alcohol in small white irregular

prisms, m. p. 99.3° (corr.). *5-Amino-2-oxydiphenyl*, $C_6H_5.C_6H_3(NH_2)(OH)$, obtained by reduction of the nitro compound, crystallizes from alcohol in small colorless needles, m. p. 198°-199° (corr.). By oxidizing this with dilute sulphuric acid and sodium pyrochromate, it was converted into *2-phenylbenzoquinone*, $C_6H_5.C_6H_3O_2$, which crystallizes from dilute acetic acid in orange-yellow leaflets, m. p. 112°-113° (corr.). *3,5-Dinitro-2-oxydiphenyl*, prepared by the action of nitric acid (sp. gr. 1.40) upon 5-nitro-2-oxydiphenyl in glacial acetic acid solution, forms yellow crystals, m. p. 207°-208° (corr.). The *sodium salt* crystallizes from water in beautiful orange-red leaflets containing two molecules of water. The anhydrous salt is crimson. In aqueous solution it is transposed by carbon dioxide. The *methyl ether* crystallizes from alcohol in colorless leaflets, m. p. 114°-115° (corr.). *3, 5-Diamino-2-hydroxydiphenyl*, formed by reduction of the dinitro body, could not be obtained in crystals or with any definite melting-point. It separated from its hydrochloride as a yellow flocculent precipitate, which rapidly changed to a red-brown powder on drying. *Nitric Acid and the Nitrohydroxydiphenyls.*—When the mono- or dinitrohydroxydiphenyls were boiled with nitric acid (sp. gr. 1.40), *p*-nitrobenzoic acid resulted. This the authors believe to be due to a preliminary nitration of the free phenyl group, with subsequent oxidation of the phenyl group carrying the OH. *Action of Nitric Acid upon the Nitrohydroxydiphenyl Methyl Ethers.*—It was found that the ethers could be further nitrated, and by heating the nitrated ethers with excess of concentrated hydrochloric acid in sealed tubes the free nitrated phenols were obtained. *3,5,4′-Trinitro-2-hydroxydiphenyl methyl ether*, prepared by nitration of 3,5-dinitro-2-hydroxydiphenyl methyl ether, forms prisms, m. p. 170°-171° (corr.). *3, 5, 4′-Trinitro-2-hydroxydiphenyl* crystallizes from alcohol in light yellow prisms, m. p. 163°-164° (corr.), and on oxidation gives *p*-nitrobenzoic acid. The *sodium salt* of the phenol crystallizes from water in matted globular aggregates of an orange-red color. *5,4′-Dinitro-2-hydroxydiphenyl methyl ether* results when 5-nitro-2-hydroxydiphenyl methyl ether is subjected to a limited nitration. It crystallizes from alcohol in very fine white needles, m. p. 222°-223° (corr.). *5,4′-Dinitro-2-hydroxydiphenyl* crystallizes from dilute alcohol in long, slender, pale yellow needles, m. p. 224°-225° (corr.). On oxidation it gave *p*-nitrobenzoic acid. By further nitration it may be converted into the 3,5,4′-trinitro-2-hydroxydiphenyl, described above. Its *sodium salt* crystallizes from water in clusters of orange-red needles. *5,2′,4′-Trinitro-2-hydroxydiphenyl Methyl Ether.*—When 5-nitro-2-hydroxydiphenyl methyl ether was boiled with twenty parts of nitric acid (sp. gr. 1.40) there resulted equal quantities of 3,5,4′-trinitro-2-hydroxydiphenyl methyl ether (see above) and 5,2′,4′-trinitro-2-hydroxydiphenyl methyl ether. The same result was obtained when 5,4′-dinitro-2-hydroxydiphenyl

methyl ether was boiled with nitric acid. 5,2',4'-Trinitro-2-hydroxydiphenyl methyl ether crystallizes from alcohol in colorless flat prisms, m. p. 104°-106° (corr.) *5,2',4'-Trinitro-2-hydroxydiphenyl*; small pointed yellow prisms, m. p. 152°-153° (corr.). The *sodium salt* crystallizes from water in small clusters of orange-red needles. On oxidizing the free phenol, 2, 4-dinitrobenzoic acid was obtained. M. T. BOGERT.

**The Reaction between Organic Magnesium Compounds and Unsaturated Compounds. II. Reactions with Derivatives of Cinnamic Acid.** BY E. P. KOHLER AND GERTRUDE HERITAGE. *Am. Chem. J.*, 33, 21-35.—The observation has been reported in a previous paper (see this Journal, 27, R, 379) that when ketones containing the group —$CH : CH.CO.C_6H_5$ react with organic magnesium compounds, only 1,4-addition occurs; thus $C_6H_5CH : CHCOC_6H_5 + C_6H_5MgBr = (C_6H_5)_2CH.CH : C(OMgBr)C_6H_5$. In the former paper only aldehydes and ketones were considered. The present paper describes similar reactions between organic magnesium compounds and bodies of the general type —$CH : CH.CO.X$, where X is either an alkoxyl group, Cl, or a secondary amine residue. In most cases the main reaction consists in a 1,4-addition of the magnesium compound to the conjugated system. Methylmagnesium iodide apparently forms an exception, but this is because, being more reactive than the corresponding aromatic compound, it first replaces the alkoxyl group with methyl (in the esters, for example), giving a methyl ketone, a type which yields only 1,2-additions: $C_6H_5CH : CHCOOR + CH_3MgI = C_6H_5CH : CH COCH_3 + CH_3OMgI$. While the magnesium compounds of the type $: C(OMgBr)OCH_3$, and the acyl derivatives obtained from them by the action of the acid halide, $:C(OCOR)OCH_3$, are stable, the products obtained by the action of water, acids, or halogens, upon these magnesium compounds, immediately rearrange to more stable forms: —$CH : C(OMgBr)OCH_3 + H_2O$(or HX) = —$CH : C(OH)OCH_3$ = —$CH_2.COOCH_3$; and —$CH : C(OMgBr) OCH_3 + Br_2$ = —$CH.C(OBr)OCH_3$ = —$CHBr.COOCH_3$. The 1,4-addition products readily combine with more of the unsaturated compound to form complex substances. EXPERIMENTAL. I. *Reactions with Esters. Methyl cinnamate and phenylmagnesium bromide*; *methyl β,β-diphenylpropionate*, $(C_6H_5)_2CHCH_2COOCH_3$. A dilute ether solution of the ester was gradually added to a solution of the magnesium compound at —10°, and the product decomposed with finely crushed ice. There was obtained in this way methyl diphenylpropionate and diphenylpropiophenone, due to the following reactions: (1) Some of the ester reacted with the magnesium compound like the ester of a saturated acid, giving the corresponding ketone, $C_6H_5CH : CHCOOCH_3 + C_6H_5MgBr = C_6H_5CH : CHCOC_6H_5 + CH_3OMgBr$. This ketone then immediately combined with the second molecule of the magnesium compound to form $(C_6H_5)_2CH.CH : C(OMgBr)C_6H_5$, hydrolysis of

which resulted in the formation of diphenylpropiophenone. (2) The rest of the ester combined direct with the phenylmagnesium bromide to $(C_6H_5)_2CH.CH : C(OMgBr)OCH_3$, from which the diphenylpropionate was produced. The methyl diphenylpropionate crystallizes from ether or ligroin in large lustrous prisms, m. p. 47°. It was also prepared by the direct esterification of the free acid. The *benzoyl derivative*, $(C_6H_5)_2CH.CH : C(OCOC_6H_5)OCH_3$, from $(C_6H_5)_2CH.CH : C(OMgBr)OCH_3$ and benzoyl chloride, forms long silky white needles, m. p. 130°-133°. On hydrolysis, it gave benzoic acid and methyl diphenylpropionate. *Methyl cinnamate and methylmagnesium iodide*; *dimethylstyryl carbinol*, $C_6H_5CH : CH.C(CH_3)_2OH$. The reaction was carried out under various conditions, the products being usually the above carbinol, and a *substance* apparently the ether of the carbinol, $(C_6H_5CH : CHC(CH_3)_2)_2O$. When an ether solution of the methylmagnesium iodide was slowly siphoned into a solution of the ester at low temperature considerable benzalacetone was formed in addition to the above compounds, indicating that the first step in the reaction is probably a direct replacement of the methoxy group of the ester by the methyl, $—COOCH_3 + CH_3MgI = —COCH_3 + CH_3OMgI$, the ketone then combining with a second molecule of methylmagnesium iodide. II. *Reaction with Cinnamyl Chloride. Cinnamyl chloride and phenylmagnesium bromide* react energetically in dilute ether solution at —20°. Among the various products of the reaction brombenzene, diphenyl, cinnamic acid, diphenylpropiophenone and diphenylpropionic acid were identified. The primary reactions of cinnamyl chloride are exactly like those of the cinnamic esters. III. *Reactions with the Ethyl Anilide of Cinnamic Acid. Cinnamyl ethyl anilide*, $C_6H_5CH : CHCON(C_2H_5)C_6H_5$, prepared from cinnamyl chloride and ethyl aniline, crystallizes from ligroin in large colorless prisms, m. p. 74°. *Diphenylpropionethyl anilide*, $(C_6H_5)_2CHCH_2CON(C_2H_5)C_6H_5$, is obtained when the product of the action of phenylmagnesium bromide upon cinnamyl ethyl anilide is decomposed by water or acids. The intermediate magnesium compound, $(C_6H_5)_2CHCH : C(OMgBr)N(C_2H_5)C_6H_5$, has the same general properties as the magnesium compounds obtained from esters by the same reaction. Treated with bromine it gave *diphenylbrompropionethyl anilide*, $(C_6H_5)_2CHCHBrCON(C_2H_5)C_6H_5$, crystallizing in large colorless prisms. *Diphenylbrompropionic acid*, from the above anilide, melts with decomposition at about 164°, is insoluble in water, readily soluble in alcohol or ether; boiled with alcoholic potash it gave β-phenylcinnamic acid. An attempt to prepare the brom acid by direct bromination of diphenylpropionic acid failed because the intermediate acid bromide formed phenylhydrindone by internal condensation, $(C_6H_5)_2CHCH_2COBr \rightarrow C_6H_4(C_6H_5)CHCH_2CO$. *β-Phenylcinnamic acid*, $(C_6H_5)_2C : CHCOOH$, crystallizes from aqueous alcohol in colorless needles,

m. p. 142°, readily soluble in alcohol or ether, moderately soluble in boiling water. It does not combine with bromine at ordinary temperatures, but instantly reduces cold permanganate solution, being thereby oxidized to benzophenone, water and carbon dioxide. M. T. BOGERT.

**The Reaction between Organic Magnesium Compounds and Unsaturated Compounds. III. Reactions with Compounds Containing Bromine.** BY E. P. KOHLER AND RUTH M. JOHNSTIN. *Am. Chem. J.*, 33, 35-45.—The object of the experiments described in this paper was to determine to what extent the reactions described in previous articles (see the above review) are influenced by the presence of halogen in the $\alpha$-position. Incidentally, the authors also studied the reaction between organic magnesium compounds and some dihalogen compounds obtained by addition of bromine to $\alpha,\beta$-unsaturated acids and $\alpha,\beta$-unsaturated ketones. They find that an $\alpha$-halogen does not materially affect the primary reaction between organic magnesium compounds and unsaturated bodies, $\alpha$-bromcinnamic ester, for example, behaving exactly like cinnamic ester. An $\alpha$-halogen, however, diminishes the tendency to formation of secondary products. Brombenzalacetophenone, hitherto generally regarded as a $\beta$-brom derivative, is shown to be an $\alpha$-derivative. The experiments with the dihalogen compounds were made in the hope of obtaining unsaturated tertiary alcohols, like diphenylstyrylcarbinol, by first making the corresponding dihalogen body and then removing the halogen. It was found, however, that the magnesium compounds invariably eliminated either hydrobromic acid or bromine, and then combined in the usual way with the resulting unsaturated body. An unsaturated magnesium compound was formed even when the ketone contained but one halogen atom. The following equations illustrate these reactions: $C_6H_5CHBrCHBrCOOC_2H_5 + 3C_6H_5MgBr = (C_6H_5)_2CHCH : C(OMgBr)OC_2H_5 + C_6H_5.C_6H_5 + 2MgBr_2$; $C_6H_5CHBrCHBrCOC_6H_5 + 2C_6H_5MgBr = (C_6H_5)_2CHCBr : C(OMgBr)C_6H_5 + C_6H_6 + MgBr_2$; and $(C_6H_5)_2CHCHBrCOC_6H_5 + 2C_6H_5MgBr = (C_6H_5)_2CHCH : C(OMgBr)C_6H_5 + C_6H_5.C_6H_5 + MgBr_2$. EXPERIMENTAL. I. *Reactions with Unsaturated Compounds. Phenylmagnesium bromide and ethyl $\alpha$-bromcinnamate* were allowed to react in ether solution and the product decomposed with water. Diphenylbrompropiophenone was separated, and the rest of the material, boiled with alcoholic potash, yielded a mixture of benzoic and $\alpha$-phenylcinnamic acids. These products are accounted for as follows: Part of the ester combines directly with the phenylmagnesium bromide to a compound which, when decomposed by water, yields $\alpha$-brom-$\beta,\beta$-diphenylpropionic ester; the latter is hydrolyzed by the hot alcoholic potash and loses hydrobromic acid, giving $\beta$-phenylcinnamic acid. The rest of the ester reacts with the phenylmagnesium bromide to form brombenzalacetophenone, which immediately combines with a

second molecule of the bromide, and this magnesium compound, on decomposition with water, gives α-brom-β,β-diphenylpropiophenone. *Methylmagnesium Iodide and Ethyl α-Bromcinnamate.*—The main product of the reaction was a teritary alcohol, $C_6H_5CH$ : $CBrC(CH_3)_2OH$. *Phenylmagnesium bromide and α-brombenzalacetophenone* gave a nearly quantitative yield of α-brom-β,β-diphenylpropiophenone, m. p. 163. When boiled with alcoholic potash, this was changed to phenylbenzalacetophenone, $(C_6H_5)_2C : CHCOC_6H_5$. The latter crystallizes from alcohol in large lemon-yellow prisms, m. p. 92°, and is oxidized by permanganate to benzophenone and benzoic acid. II. *Reactions with Saturated Halogen Compounds. Phenylmagnesium Bromide and Stilbene Bromide.*—The product of this reaction was decomposed by dilute hydrochloric acid, giving stilbene and diphenyl. *Phenylmagnesium bromide and dibromphenylpropionic ester* reacted similarly, giving ethyl cinnamate (by loss of bromine), which then combined with more of the bromide to compounds which, when decomposed by water, gave diphenylpropionic ester and diphenylpropiophenone. *Phenylmagnesium bromide and benzalacetophenone bromide,* at low temperature, yielded diphenylpropiophenone and bromdiphenylpropiophenone, while at the boiling-point of ether the products were diphenyl and diphenylpropiophenone. *α-Naphthylmagnesium bromide and benzalacetophenone bromide* gave *naphthylphenylpropiophenone,* which crystallizes in needles, m. p. 121°. The same substance was obtained from benzalacetophenone and α-naphthylmagnesium bromide. *Phenylmagnesium Bromide and α-Bromdiphenylpropiophenone.*—The products were diphenylpropiophenone and diphenyl.

M. T. BOGERT.

**On Derivatives of Formhydroxamic Acid and the Possible Existence of Esters of Fulminic Acid.** BY H. C. BIDDLE. *Am. Chem. J.*, 33, 60–68.—Methylformylchloride oxime, $CH_3ON:CHCl$, when treated with potassium hydroxide, yields minute quantities of a neutral unsaturated body of strong isonitrile odor, together with other substances. The author thinks it probable that this body is the fulminic ester, $CH_3ON : C$, but the amount obtained was not sufficient for its isolation or identification. EXPERIMENTAL. *Synthesis of α-Methyl Hydroxylamine Hydrochloride,* $CH_3ONH_2.HCl$.—Dibenzhydroxamic acid was first prepared, converted into its silver salt, then into the ethyl ester, from this ethylbenzhydroxamic acid was obtained, the methyl ester of which, on saponification with hydrochloric acid, gave the methoxylamine hydrochloride and ethyl benzoate: $2C_6H_5COCl + H_2NOH \rightarrow C_6H_5C(OH) : NOCOC_6H_5 \rightarrow C_6H_5C(OC_2H_5) : NOCOC_6H_5 \rightarrow C_6H_5C(OC_2H_5) : NOH \rightarrow C_6H_5C(OC_2H_5) : NOCH_3 \rightarrow C_6H_5COOC_2H_5$ and $CH_3ONH_2.HCl$. From 250 grams hydroxylamine hydrochloride, 70 grams of the methyl derivative were obtained, crystallizing in snow-white hygroscopic leaflets, m. p. 148°-149°, and not reducing Fehling's solu-

tion. *Methylester of formhydroxamic acid*, $CH_3ONH.COH$, from $\alpha$-methylhydroxylamine and formic acid forms colorless prismatic deliquescent crystals, m. p. 38°-39°, b. p. 116°-117° at 33 mm.; 123°-124° at 45 mm.; and 126°-127° at 50 mm. The *silver salt* of the ester forms snow-white leaflets, which react in the cold with acetyl and benzoyl chlorides, and with methyl and ethyl iodides, giving the corresponding acyl and alkyl derivatives. Equal molecules of the methyl ester and phenylisocyanate combine to an *addition-product*, crystallizing in colorless leaflets, m. p. 123°-123.5°, whose structure has not yet been determined. *Methyl formyl chloride oxime*, $CH_3ON : CHCl$, from methyl formhydroxamate and phosphorus pentachloride, is a colorless liquid, boiling at 68°, slightly soluble in water, with an odor very much like that of chloroform, and is very stable. It is immediately decomposed by caustic alkalies. If the powdered alkali be added carefully to the well-cooled oxime, or, better, to its solution in dry ether or ligroin, an intense isonitrile odor is immediately produced. This odor the author believes to be due to the formation of minute quantities of methyl fulminate, $CH_3ON : C$, for the reasons which follow. The alkali removes all the chlorine from the methylformylchloride oxime, and, if the solution be kept cool, the isonitrile odor is unaccompanied by any ammoniacal odor or reaction; apparently, an unsaturated body is formed, since the ligroin solution instantly decolorizes a small amount of bromine. A solution of methylformylchloride oxime in absolute ether was treated with powdered potassium hydroxide and allowed to stand until the reaction was completed. After evaporation of the ether, a minute quantity of liquid, with strong isonitrile odor, distilled over at about 50°-60°, the residue in the flask being apparently methyl formhydroxamate. The amount of isonitrile compound obtained was too small for purification, but, with care, the same characteristic isonitrile odor was obtained by the action of alcoholic potash and chloroform upon $\alpha$-methylhydroxylamine hydrochloride, a reaction which should naturally give rise to a methyl fulminate, $CH_3ONH_2 \rightarrow CH_3ONC$. M. T. BOGERT.

**On the Reactions of Sodium Benzhydrol.** BY RAYMOND FOSS BACON. *Am. Chem. J.*, 33, 68-97.—The study of the dissociation phenonmena in the benzhydrol series was undertaken, first, because Knoevenagel has recently assumed a direct dissociation of benzhydrol into benzophenone and hydrogen, and, secondly, because it would probably be easy to trace all the products, since they are crystalline and their quantitative separation has already been thoroughly worked out by Nef. It was found that formic, acetic and isobutyric acids could be alkylated by means of sodium benzhydrol. The experiments also lead to an investigation of the action of sodium on benzyl acetate and allied compounds, and thus to a complete revision of the work in this field carried

out by Conrad and Hodgkinson twenty-five years ago. Experimental. *The preparation of sodium benzhydrol* was carried out by Nef's method. It crystallizes from ether in colorless transparent plates, occasionally 2 cm. to 3 cm. long, and rapidly absorbs water and oxygen from the air. It turns green or greenish blue in the light, and becomes colorless again over night. The *Dissociation of Sodium Benzhydrol.*—The products formed by heating the salt to its dissociating point (250°) were benzene, sodium benzoate and diphenylmethane, with occasionally some tetraphenylethane and tetraphenylethylene. *The Spontaneous Combustion of Sodium Benzhydrol in Dry Air.*—When dry air and oxygen were passed over sodium benzhydrol at ordinary temperature the products were benzophenone, sodium benzoate and sodium dioxide. *On the Combustion or Oxidation of Bromdiphenylmethane.*—When bromdiphenylmethane was oxidized by cold acid permanganate solution benzophenone was produced. When dry oxygen was passed through fused bromdiphenylmethane (at 160°-170°) benzophenone and tetraphenylethylene were formed. The action of sodium upon an absolute ether solution of bromdiphenylmethane resulted in the formation of tetraphenylethane and diphenylmethane. *The Action of Sodium Benzhydrol on Benzhydrol Acetate. Benzyl acetoacetate,* $CH_3C(OH)$ : $CHCOOCH_2C_6H_5$, from ethyl acetoacetate and benzyl alcohol is a colorless mobile oil, boiling at 162°-164° at 16 mm. and was first prepared by Shaklee. *Benzhydrol acetoacetate,* $CH_3C(OH)$ : $CHCOOCH(C_6H_5)_2$, was prepared in similar manner, by heating ethyl acetoacetate with benzhydrol. It crystallizes from ether-ligroin in colorless plates, m. p. 56°. The *copper salt* separates from benzene as a powder, m. p. 174°-176°. From mixtures of benzhydrol acetate and sodium benzhydrol only very small amounts of benzhydrol acetoacetate could be obtained. When the two were heated together in a sealed tube at 100° the products were $\beta$-diphenylpropionic and acetic acids, benzhydrol acetoacetate and benzhydrol. Benzhydrol acetoacetate heated with sodium benzhydrol gave benzhydrol and small amounts of benzophenone. The action of sodium upon a dry ether solution of benzhydrol acetate resulted in the formation of benzhydrol with but traces of benzhydrol acetoacetate. When equal molecules of sodium benzhydrol and benzhydrol acetate were heated together at 300° a yield of 75 per cent. of the theoretical amount of $\beta$-diphenylpropionic acid was obtained. *Benzhydrol $\beta$-Diphenylpropionate,* $(C_6H_5)_2$ $CHCH_2COOCH(C_6H_5)_2$.—$\beta$-Diphenylpropionic acid melts at 155° (Henderson gives it as 151°). The potassium salt, dissolved in an equal weight of the free acid, was heated with bromdiphenylmethane at 150°-160°, giving the benzhydrol ester. The latter crystallizes from alcohol in colorless needles, m. p. 112°, and is readily saponified by alcoholic potash. *On the Alkylation of Acetic Acid by Sodium Benzhydrol.*—Ethyl acetanilide and sodium

benzhydrol, heated together in a sealed tube at 160°-220°, gave ethyl aniline, benzhydrol, benzhydrol ether, tetraphenylethane, benzophenone and β-diphenylpropionic acid. Benzhydrol acetate and quicklime, heated together in a sealed tube at 230°-250°, gave the same products, except ethyl aniline. When benzhydrol acetate and sodium benzhydrol were heated together in a sealed tube at 150°-160° the products were β-diphenylpropionic acid, its benzhydrol ester, benzhydrol, benzhydrol ether, tetraphenylethylene, traces of tetraphenylethane and a small amount of benzophenone. Ten grams of benzhydrol acetate heated to 300°-350° with 20 grams of sodium benzhydrol, gave 7.5 grams β-diphenylpropionic acid, 0.2 gram benzoic acid, 4 grams diphenylmethane and benzophenone. When benzhydrol acetate was heated with sodium at 130°-140° the products were β-diphenylpropionic acid, benzhydrol, tetraphenylethylene, traces of tetraphenylethane and benzophenone. *Alkylation of Benzhydrol Formate. Benzhydrol formate* was prepared from bromdiphenylmethane, formic acid and potassium formate. It is a neutral colorless oil, boiling at 159°-160° at 10 mm. pressure. Heated with sodium benzhydrol at 300°-301° in a sealed tube some diphenylacetic acid was formed. *Benzhydrol isobutyrate*, prepared from bromdiphenylmethane in similar manner, melts at 54° and boils at 185°-187° at 15 mm. pressure. *Alkylation of Benzhydrolisobutyrate, 1-Dimethyl-2-diphenylpropionic Acid*, $(C_6H_5)_2CHC(CH_3)_2COOH$.—Benzylisobutyrate and sodium benzhydrol, heated together in a sealed tube at 190°-220°, gave 1-dimethyl-2-diphenylpropionic acid, benzhydrol, diphenylmethane, and benzophenone. When benzhydrol isobutyrate and sodium benzhydrol were heated together under various conditions, one or more of the following products resulted: Isobutyric, monoalkylated isobutyric, benzoic and 1-dimethyl-2-diphenylpropionic acids, benzhydrol, diphenylmethane, and benzophenone. 1-Dimethyl-2-diphenylpropionic acid crystallizes from ligroin in plates, m. p. 134°. *The Dissociation of Benzhydrol Acetate.*—At 300°-310° 60 per cent. of the benzhydrol acetate decomposed into tetraphenylethylene and acetic acid; some benzophenone and diphenylmethane also were formed. A sealed tube containing benzhydrol acetate was exposed to the sun for over five months, when 25 per cent. of the acetate was found to have been decomposed into acetic acid and tetraphenylethylene. Benzhydrol ethyl ether decomposes at 300°, in absence of air, into acetaldehyde, tetraphenylethane, and benzophenone. Benzyl chloride heated with anhydrous potassium oxalate at 160° gives a small yield of *s*-tetraphenylbutane. *On the Action of Sodium on the Benzyl Esters of Acetic, Propionic, Butyric, and Isobutyric Acids. A Revision of Conrad and Hodgkinson's Work.*—Conrad and Hodgkinson reported the chief product of the action of sodium upon the benzyl esters of the above acids to be the α-monobenzylated derivatives of these esters., *e* g., benzyl hydrocinnamate,

$(C_6H_5CH_2)CH_2COOCH_2C_6H_5$, from benzyl acetate and sodium. *Benzyl hydrocinnamate*, prepared from the silver salt and benzyl chloride, is a colorless oil, b. p. 190°-195° at 10 mm., which is readily saponified by cold alcoholic potash. *Repetition of Conrad and Hodgkinson's experiment with sodium and benzyl acetate* showed that two-thirds of the high-boiling oil obtained consisted of benzyl hydrocinnamate and one-third of benzyl ether, and that, judging from their data, Conrad and Hodgkinson must have had relatively far more benzyl ether in their high-boiling oil. *Benzyl isobutyrate and sodium benzylate* were heated together in a sealed tube for four hours at 300°-310°. The chief products were benzyl alcohol and benzyl ether, with isobutyric and benzoic acids, and traces of benzaldehyde. Benzyl ether very slowly yields toluene and benzoic acid on prolonged digestion with alcoholic potash at 150°, or on heating with solid potash or soda-lime at 200°. The author regards Hodgkinson's "α-benzylated isobutyric benzyl ester" as probably only benzyl ether. M. T. BOGERT.

**Notes on Organic Analysis.** BY HENRY C. SHERMAN. *School of Mines Quarterly*, **26**, 1-47.—This is the first instalment of a set of notes, written primarily for the use of students in organic and sanitary analysis at Columbia University, and arranged to give a connected view of organic analysis as applied to plant and animal substances and their manufactured products. The following chapters are given: I. Introduction; II. Nitrogen, Sulphur and Phosphorus; III. Alcohols. M. T. BOGERT.

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## BIOLOGICAL CHEMISTRY.

**On Bilirubin, the Red Coloring Matter of the Bile.** BY W. R. ORNDORFF AND J. E. TEEPLE. *Salkowski Festschrift*, 1-30.—Analyses of the pure, crystallized bilirubin show, that its composition corrected is represented by the formula $(C_{16}H_{18}N_2O_3)$. Bilirubin unites with diazo compounds in acid or neutral solutions to form two series of azo compounds, monazo and diazo compounds. Analyses of the monazo compounds show that they have the formula $C_{32}H_{35}N_4O_6(N_2R)$. They are formed in much smaller quantity than the diazo compounds, are more readily soluble in alkalies and are not precipitated from these solutions by carbon dioxide. Their solutions show no absorption bands. In most neutral solvents like carbon bisulphide, chloroform and acetic ether they are less soluble than the diazo compounds. Analyses of the diazo compounds show that they have the formula, $C_{32}H_{34}N_4O_6(N_2R)_2$. They are soluble in alkalies, and are precipitated from these solutions by carbon dioxide. Their solutions show characteristic absorption bands. The existence of two series of azo compounds, the monazo with the formula $C_{32}H_{35}N_4O_6(N_2R)$, and the disazo with the formula $C_{32}H_{34}N_4O_6(N_2R)_2$, shows that the

molecular formula for bilirubin must be $C_{32}H_{36}N_4O_6$. The molecular weight determinations of the tribrombenzenediazobilirubin are in accord with the results of the analyses of the azo compounds and show that this substance is correctly represented by the formula $C_{32}H_{34}N_4O_6(N_2C_6H.Br_3)_2$, and hence that the formula of bilirubin is $C_{32}H_{36}N_4O_6$. Bilirubin has acid properties similar to those of the phenols. It is precipitated from its alkaline solutions by carbon dioxide. It contains no alkyloxy-group and probably no alkylimide group. It does not reduce an ammoniacal solution of silver nitrate, even when the solution is boiled, so that it probably does not contain an aldehyde group. It resembles resorcinol very closely in the manner in which it forms monazo and disazo-products. When reduced with zinc dust or with nascent hydriodic acid, obtained by the action of phosphorus tetraiodide on water, bilirubin gives homopyrrol, thus showing that it is a derivative of pyrrol. The ease with which bilirubin forms monazo and disazo compounds with diazonium salts, even in the presence of strong acids, also points to the same conclusion.

F. P. UNDERHILL.

**Further Experiments on the Haemolysinogenic and Agglutininogenic Action of Laked Corpuscles.** BY G. N. STEWART. *Am. J. Physiol.*, **12**, 363-374.—A continuation of the researches recently made by Stewart (*Am. J. Physiol.* **11**, 250) giving additional proof of the view advanced that the stromata and liquid of water-laked corpuscles possess agglutininogenic and hemolysinogenic powers. Both cause the production of sera with specific hemolytic and agglutinating power, the latter being most marked, as is also the case with the serum obtained after the injection of stromata laked by freezing and thawing. Filtration through porous earthenware appears to remove the agglutininogens and hemolysinogens from the liquid of corpuscles laked by freezing and thawing and by foreign serum. F. P. UNDERHILL.

**Further Proof of Ion Action in Physiologic Processes.** BY C. HUGH NEILSON AND ORVILLE H. BROWN. *Am. J. Physiol.*, **12**, 374-387.—This research was carried out in order to present additional evidence in support of the statement made by the authors (*Am. J. Physiol.* **10**, 335) that the results obtained from the action of electrolytes upon the decomposition of hydrogen dioxide by platinum black and by a watery extract of pancreas could be explained, in general, by the assumption that the cations or positive ions have a depressing or retarding action and the anions or negative ions have a stimulating effect. The present experiments were carried out with a watery extract of the beef kidney. It was found that non-electrolytes have no effect upon the decomposition of hydrogen dioxide by platinum black, or by a watery extract of kidney, except in solutions of one mol concentration, or more; in concentrations stronger than one mol there is an

inhibitory effect which increases with the increasing concentration. A salt in dilute concentration exerts either a depressing or stimulating effect upon the decomposition of hydrogen peroxide by platinum black, or a watery extract of the kidney by virtue of its ionic condition. The stimulating effect of a salt upon the splitting of peroxide of hydrogen by platinum black, or a watery extract of the kidney, depends upon the negative ion, while the retarding effect depends upon the positive ion.

F. P. UNDERHILL.

**The Production of Choline from Lecithin and Brain-Tissue.** BY ISADOR H. CORIAT. *Am. J. Physiol.*, **12**, 353-363.—The putrefaction of either human, calf or egg lecithin in a neutral medium yields choline, the reaction at the same time becoming acid. Human lecithin, by putrefaction alone, yields less choline than either egg or calf lecithin, but the amount is about equal to the yield from brain tissue during autolysis, but is less than the theoretical yield by calculation from the equation of the hydrolysis of lecithin. The putrefaction of brain-tissue alone produces choline in a greater quantity than autolysis alone. Lecithin is not split on prolonged contact with acids (hydrochloric and acetic), but it can be split by heating it with barium hydroxide and will give a theoretical yield of choline. Neither pepsin nor trypsin is effective in splitting off the methyl group from any of these lecithins so that choline may be produced. Lipase, however, is capable of splitting lecithin. Pepsin and trypsin not only fail to act on the lecithin of brain-tissue, but actually seem to inhibit or even destroy autolysis. There is an enzyme present in brain-tissue, capable of splitting choline from lecithin The enzyme acts only in neutral or slightly alkaline media, and the yield of choline in the latter is greater than in the former. The enzyme is inactive in slightly acid media. It is destroyed by heating, and then, if the suspension of the brain-tissue be kept sterile, no choline is produced; if putrefaction is allowed to supervene, choline will be formed in a greater quantity than by autolysis alone. Prolonged action with antiseptic precautions and with very slight preliminary heating, to destroy only part of the enzyme, produces a very small amount of choline. As with all enzymes, there is an inhibitory influence of reaction-products which cannot be removed, and this explains the low percentage of choline obtained Efforts to isolate this enzyme have been unsuccessful. The choline produced in the combined action of autolysis and putrefaction is nearly equal to the sum of each, when acting separately in similar media, and nearly approaches the theoretical amount, which should be yielded by the percentage of lecithin in weight of the brain-tissue used. In these observations the estimation of choline was made from the crystals of the platinum salt.

F. P. UNDERHILL.

**The Passage of Different Food-stuffs from the Stomach and through the Small Intestine.** By W. B. Cannon. *Am. J. Physiol.*, **12**, 387-419.—Fat, carbohydrate, and proteid foods, uniform in amount (25 cc.) and consistency, were mixed with a small amount of subnitrate of bismuth and fed to cats deprived of food for at least twenty-four hours. The rate of gastric peristalsis observed by means of the Röntgen rays was usually slower for fats (5.2 waves per minute) than for carbohydrates (5.8 waves per minute). At regular intervals for seven hours after feeding, the shadows of the intestinal contents were traced on transparent paper by means of a fluorescent serum and the Röntgen rays. Fats remain long in the stomach. The discharge of fats begins slowly and continues at nearly the same rate at which the fat leaves the small intestine by absorption and by passage into the large intestine. Consequently, there is never any great accumulation of fat in the intestine. Carbohydrate foods begin to leave the stomach soon after their ingestion. They pass out rapidly, and at the end of two hours reach a maximum amount in the small intestine almost twice the maximum for proteids, and two and a half times the maximum for fats, both of which maxima are reached only at the end of four hours. The carbohydrates remain in the stomach only about half as long as the proteids. Proteids frequently do not leave the stomach at all during the first half-hour. After two hours they accumulate in the small intestine to a degree only slightly greater than that reached by carbohydrates an hour and a half earlier. The departure of proteids from the stomach is, therefore, slower at first than that of either fats or carbohydrates. An exception, however, is found in egg albumin. When carbohydrates are fed first and proteids second, the presence of proteids in the cardiac end of the stomach does not materially check the departure of the carbohydrate food lying at the pylorus; but the presence of proteids at the pylorus, when proteids are fed first and carbohydrates second, markedly retards the onward passage of the carbohydrates which, under these circumstances, predominate in the cardiac end of the stomach. When carbohydrates and proteids are mixed in equal parts, the mixed food does not leave the stomach so slowly as the proteids, nor so rapidly as the carbohydrates. The discharge is intermediate in rapidity. In a mixture of fats and proteids in equal parts the presence of the fats causes the proteid to leave the stomach even more slowly than the proteid by itself. Fat mixed with carbohydrate in equal amounts also causes the carbohydrates to pass the pylorus at a rate slower than their normal. Doubling the amount of carbohydrate food (50 cc. instead of 25 cc.) increases the rapidity of the carbohydrate outgo from the stomach during the first two hours, whereas, doubling the amount of proteid food strikingly delays the initial discharge of proteid from the stomach. The process of rhythmic segmentation is seen with

all three kinds of food-stuffs, and the frequency of its occurrence corresponds roughly to the amount of food present in the intestine. During the first seven hours after feeding, the amount of segmenting activity in the presence of carbohydrates was much greater than in the presence of either fats or proteids. Egg albumin is excepted in this general statement. The interval between the feeding and the appearance of food in the large intestine is variable, but the mean for carbohydrates is about four hours, for proteids about six hours, and for fats about five hours. It is probable that proteids pass through the small intestine more slowly than do the carbohydrates. F. P. UNDERHILL.

**Long and Short Methods of Calculating Modified Milk.** BY E. KIRKLAND SHELMERDINE. *N. Y. Med. J.*, Nov. 19, 1904.
F. P. UNDERHILL.

**Methyl Alcohol.** BY H. W. WILEY. *N. Y. Med. J.*, Nov. 26, 1904. F. P. UNDERHILL.

**An Electrically Heated and Controlled Thermostat.** BY R. H. MACUMBER AND C. G. L. WOLF. *J. Path. and Bacteriol.*, Edinburgh and London, Nov., 1904, pp. 105–110.—A thermostat designed for bacteriological and chemical purposes is described in which the heating is done by means of uncoiled resistance wire. The conducting medium is air. The controlling mechanism is a relay actuated by the heating circuit. The accuracy of control is about 0.01°. F. P. UNDERHILL.

**Some Aspects of the Newer Physiology of the Gastrointestinal Canal.** BY LAFAYETTE B. MENDEL. *J. Am. Med. Assoc.*, Nov. 19, 1904. F. P. UNDERHILL.

**The Present Problems of Physiological Chemistry.** BY RUSSELL H. CHITTENDEN. *Pop. Sci. Monthly*, Dec., 1904.
F. P. UNDERHILL.

**Diabetes Mellitus. Report on a Case, Including a New Method of Prognosis.** BY ARTHUR R. MANDEL AND GRAHAM LUSK. *J. Am. Med. Assoc.*, July 23, 1904; also *Deutschen Arch. f. Klin. Med.*, 81, 472–493.—A diabetic patient with a low acidosis and with no trace of albumin in the urine, when put on a meat-fat diet, showed a constant ratio of dextrose to nitrogen in the urine. The ratio was dextrose : nitrogen :: 3.65 : 1, and is the same as that found in dogs made diabetic with phlorhidzin. This ratio was uninfluenced by fat digestion or by fat metabolism. The sugar was, therefore, derived from proteid alone, and rose and fell with the proteid metabolism as indicated by the amount of urinary nitrogen. The patient died five weeks later. There was apparently a complete intolerance for carbohydrates indicated by the following facts: 85 per cent. of starch and 80 per cent. of

levulose fed were excreted as sugar in the urine, withdrawal of the carbohydrates from the diet and the continuance of the same proteid-fat quantity in the food had no effect on the excretion of nitrogen in the urine. A sufficient quantity of meat and fat for the body's needs was readily assimilated. Only 4 per cent. of the available energy of the food appeared in the feces. The urea excretion was normal. The sulphate elimination ran normally proportional to the proteid metabolism. The phosphates ran abnormally high, as is usual in diabetes. The above research, when considered in the light of other work to be found in the literature, enables one to formulate a new clinical method of prognosis in diabetes, using the D : N ratio for this purpose. The procedure is as follows: If a diabetic patient be put on a meat-fat diet (rich cream, meat, butter and eggs), and the twenty-four hours urine of the second day be properly collected, the discovery of 3.65 grams of dextrose to 1 gram of nitrogen signifies a complete intolerance for carbohydrates, and probably a quickly fatal outcome. This has been called the fatal ratio. A lower relation between dextrose and nitrogen means that some proteid sugar may be burned. Such a tolerance for sugar may be increased on a meat-fat diet, so that the D : N ratio falls, or the sugar in favorable cases may entirely disappear from the urine. F. P. UNDERHILL.

**Changes in the Excretion of Carbon Dioxide Resulting from Bicycling.** BY G. O. HIGLEY AND W. P. BOWEN. *Am. J. Physiol.*, **12**, 311–336.—The experiments, carried out upon men, were undertaken to determine the relation of the excretion of carbon dioxide to the pulse rate during successive periods of rest, vigorous muscular exercise (stationary bicycle) and recovery. The quantity of carbon dioxide excreted was recorded graphically by means of a form of apparatus (chemograph) devised by the authors especially for such researches. The principle of the apparatus is to absorb the carbon dioxide as fast as formed by means of a counterpoised absorbing chamber attached to a delicate balance which, in turn, is attached to a recording lever. From observations made on twenty experiments relative to the rate of the output of carbon dioxide as a result of muscular work it was found that there is a latent period of from seventeen to twenty-two seconds in the increased output of the carbon dioxide from the lungs in the case of beginning work, and that the increase reaches a maximum in about two minutes. The output of carbon dioxide from the lungs is practically uniform from minute to minute during uniform muscular work, after the blood has had time to take part fully in the process of elimination. Upon cessation of work the output of carbon dioxide decreases to the normal amount in about the time occupied by its increase, and after a similar latent period. The results obtained show no indication of any

connection of cause and effect between the production and elimination of carbon dioxide and the secondary rise of pulse-rate.

F. P. UNDERHILL.

**On the Absorption and Utilization of Proteids without Intervention of the Alimentary Digestive Processes.** BY LAFAYETTE B. MENDEL AND ELBERT W. ROCKWOOD. *Am. J. Physiol.*, **12**, 336–352.—Vegetable proteids (crystallized edestin from hempseed and excelsin from the Brazil nut) slowly introduced in solution into the circulation of animals (cat, dog, rabbit) can apparently be retained in the organism for the most part, even when the quantities introduced almost equal that of the globulins normally present in the blood. At any rate, they are not eliminated unchanged in the urine (or in the bile, in the few experiments tried). When solutions are injected too rapidly or in too great concentration, toxic symptoms, including an inhibition of the cardiac and respiratory activities, may be observed, especially in cats. This corresponds with observations of Brodie after serum-proteid injections in these animals. The chemically similar proteids, edestin and excelsin, show slight differences in physiological action, a small amount of a proteose-like substance being found in the urine after intravenous or intraperitoneal (parenteral) introduction of excelsin, but not with edestin. The vegetable proteids soon disappear in considerable part when introduced into the peritoneal cavity. That they reach the circulation is made probable in the case of excelsin at least by the appearance of the typical urine proteose-body noted after direct intravenous injections. For the most part, however, the proteids do not reappear in the urine. The unaltered proteids edestin and casein are absorbed to a very small extent, if at all, from portions of the living small intestine in which the ordinary digestive processes are excluded as far as possible. On the other hand, the proteoses and peptones obtained from peptic digestion of these proteids readily disappear from the intestine under the same conditions. It is not necessary to assume that in these cases they are first completely broken down by the intestinal enzyme erepsin, for casein (upon which erepsin can act) may remain unabsorbed. Dissolved edestin could be recovered in crystalline form, that is, unchanged after remaining in the intestine for several hours. The typical vegetable proteids show no marked differences from those of animal origin in their relation to the processes of metabolism. F. P. UNDERHILL.

**The Relation of Physiological Chemistry to the Development of Medical Education.** BY RUSSELL H. CHITTENDEN. *Univ. of Penn. Med. Bull.*, June, 1904. F. P. UNDERHILL.

**A Method for Inoculating Animals with Precise Amounts.** BY M. J. ROSENAU. *Bull. No. 19*, Hyg. Lab., U. S. Pub. Health

and Mar. Hosp. Serv., Washington, pp. 1–7.—A modified form of syringe is described by means of which the greatest of accuracy may be obtained in the amounts of solutions injected.

F. P. UNDERHILL.

**The Physiological Action of Azoimide.** BY LETCHWORTH SMITH AND C. G. L. WOLF. *J. Med. Research*, 12 (New Series 7) 451-475.—The experiments carried out on rabbits and dogs show that azoimide (hydronitric acid) is a protoplasmic poison, resembling in its action hydrocyanic acid. Nerve and muscle are paralyzed, with a preliminary stage of increased excitability. Both nerve and muscle appear to be affected simultaneously. The vapor of azoimide inhaled causes excitation of the respiratory centers with subsequent paralysis. The blood pressure is lowered and is due primarily to vaso-motor disturbance. The intestine and kidney take part in vaso-dilatation in exceptional instances only. Other of the viscera are the main factors in the process. The acid is the most powerful compound containing the trinitrogen group. The introduction of a phenyl radical diminishes the effect of the complex. Azoimide forms a compound with methemoglobin similar to that formed by hydrocyanic acid. Neither the existence of an azoimide hemoglobin or an azoimide hematin could be demonstrated.

F. P. UNDERHILL.

**The Differentiation of Bacillus Diphtheriae, Bacillus Xerosis, and Bacillus Pseudo-diphtheriae, by Fermentation Tests in the Serum-water Media of Hiss.** BY ARNOLD KNAPP. *J. Med. Research*, 12 (New Series 7) 475–479.—The method of Hiss (*Centrbl. f. Bakt.*, 1902, and *Med. News*, Feb. 14, 1903) consists in the use of serum-water media. The medium is composed of beef serum 1 part, distilled water 3 parts, and is practically sugar-free. After heating to 100° for a short time to destroy the enzymes of the blood 1 per cent. additions of the following sugars are made: Glucose, mannite, maltose, lactose, saccharose and dextrin. Finally litmus solution (Merck's pure litmus, 5 per cent. in water) is added to the proportion of 1 per cent. The media are tubed and sterilized for ten minutes on three consecutive days. The growth of organisms in these media may, according to their physiological peculiarities, be associated with the production of acid, and a consequent reddening and coagulation of the media containing certain of these sugars. Thus, if different sugars are affected, a means of differentiation is furnished. By this method twenty-seven cultures of diphtheria bacilli, ten cultures of Xerosis bacilli and four cultures of pseudo-diphtheria bacilli were tested. The diphtheria bacilli culture and the culture of *Bacillus Xerosis* ferment, glucose, mannite and maltose. The latter ferments saccharose, but the former

does not. Dextrin is fermented by diphtheria bacilli, but not by the xerosis bacilli. Pseudo-diphtheria bacilli do not ferment any of the sugars tested; hence a study in saccharose and dextrin media will serve to differentiate these three types of organisms. F. P. UNDERHILL.

**The Effect of Filtration on Bacteriolytic Complements.** BY EDNA STEINHARDT. *J. Med. Research* 12 (New Series 7) 479–490.—Bacteriolytic complements gradually pass through a Berkefeld filter. The retention by the filter of the complement of the first portion of the filtrate is due to adsorption. Quantitative differences of bacteriolytic complements in the original serum offer a partial explanation of their differentiation by filtration. F. P. UNDERHILL.

**Specific and Non-specific or Group Agglutinins.** BY W. H. PARK AND KATHARINE R. COLLINS. *J. Med. Research*, 12 (New Series 7) 491-509.—The protoplasm of a single variety of bacteria when injected into a suitable animal (rabbit, goat, horse) excites the production of a number of agglutinins. A part of these are specific and the remainder non-specific (called group agglutinins). If an animal is chosen for injections of bacteria whose serum does not as yet contain appreciable agglutinins for the bacteria used it will be found that in the immunization there is at first a greater development of specific than of group agglutinins. If the injections are continued the amount of specific agglutinins will rise to a certain height and then diminish. At the same time the common agglutinins will also diminish, but more slowly. The statement that the bactericidal properties of a serum can be judged by its agglutinating strength is not founded on fact, since the agglutinins frequently decrease while the bactericidal substances remain or even increase. F. P. UNDERHILL.

**The Chemical Findings in the Cerebro-spinal Fluid and Central Nervous System in Various Mental Diseases.** BY ISADOR H. CORIAT. *Am. J. Insanity*, 60, 733–760.—The fluid was secured from ten minutes to nineteen hours after death and was of a clear slightly yellow tinge. In all but two cases the reaction varied from slightly to strongly acid, due to lactic acid. The specific gravity varied from 1.006 to 1.012. In some cases glucose was present in quite significant quantities (about 0.055 gram per 100 cc. of fluid). Urea, in those cases where it was estimated, varied from 0.1 to 0.5 gram per 100 cc. fluid. In only three cases was the freezing-point below that of normal blood serum. Nucleoproteid, serum albumin and globulin are always present. Choline was quantitatively determined and the largest amount was found in general paralysis. The percentages of proteid and choline appear to run parallel. Cho-

lesterol was always absent, but phosphates and sulphates were always present. F. P. UNDERHILL.

**Physiological Economy in Nutrition, with Special Reference to the Mineral Proteid Requirement of the Healthy Man. An Experimental Study.** BY RUSSELL H. CHITTENDEN. F. A. Stokes Co., New York, 1904, pp. 1–478.—The purpose of the experiments here recorded was to throw light upon the question of a possible physiological economy in nutrition with special reference to the minimal proteid requirement of the healthy man under the ordinary conditions of life. In most of the previous investigations on nutrition attention has been devoted to the determination of the amount of food consumed rather than to the quantity necessary for the needs of the body. The experiments were carried out upon men representing three distinct types or classes of individuals: (1) A group of five men of varying ages connected with Yale University as professors and instructors as representatives of the mental worker rather than the physical worker. (2) A detail of thirteen men, volunteers from the Hospital Corps of the United States Army and representatives of the moderate worker, men who for a period of six months took each day a vigorous amount of systematic exercise in the gymnasium, in addition to the routine work connected with their daily life as members of the United States Hospital Corps; these men were of different ages, temperaments and nationalities. (3) A group of eight young men, students in Yale University, all trained athletes. In the case of the professional group of men there was perfect freedom in the choice of food. Some of the subjects chose their ordinary diet, but with a marked diminution of the amount of proteid food, accompanied by a gradual reduction of the total amount of food consumed each day. Others chose a diet strictly more vegetarian in character. It is shown by the results of the experiments that these men maintained their body-weight, pursued their ordinary vocations without loss of strength and vigor, and kept in a condition of perpetual good health with an average daily metabolism of from 5.4 grams of nitrogen to 8.99 grams of nitrogen for periods ranging from six to eighteen months, and the total fuel value of the food taken in did not exceed 2,500 calories. The following table shows the average daily excretion through the urine for periods of from seven to nine months:

PROFESSIONAL GROUP.

| Subject. | Body weight. Kilos. | Total nitrogen. Grams. | Uric acid. Gram. | Ratio of uric acid to nitrogen. | Uric acid per kilo body weight. Gram. | Phosphoric acid ($P_2O_5$). Grams. |
|---|---|---|---|---|---|---|
| R. H. C.......... | 57.9 | 5.69 | 0.392 | 1 : 14 | 0.0068 | 0.90 |
| L. M. B.......... | 70.0 | 6.53 | 0.419 | 1 : 15 | 0.0060 | 1.46 |
| F. P. U.......... | 65.0 | 7.43 | 0.516 | 1 : 14 | 0.0079 | 1.28 |
| A. L. D.......... | 65.0 | 8.99 | 0.386 | 1 : 23 | 0.0059 | 1.73 |
| G. M. B.......... | 61.5 | 8.58 | 0.365 | 1 : 23 | 0.0059 | 1.49 |

With the soldiers the diet was prescribed in such a way that a gradual diminution in the amount of proteid food was made, with some reduction likewise in the total fuel value of the food. The members of this group lived without discomfort for a period of five months upon a daily diet involving the metabolism of only 7 to 9 grams of nitrogen and with a fuel value of less than 2,800 calories per day. Body-weight, nitrogenous equilibrium, physical strength and vigor, ability to respond to sensory stimulation, the condition and the composition of the blood all remained unimpaired. The following table shows the average daily excretion through the urine for a period of five months:

SOLDIER DETAIL.

| Subject. | Body weight. Kilos. | Total nitrogen. Grams. | Uric acid. Gram. | Ratio of uric acid to nitrogen. | Uric acid per kilo of body weight. Gram. | Phosphoric acid ($P_2O_5$.) Grams. |
|---|---|---|---|---|---|---|
| W. H. O | 62 | 7.42 | 0.405 | 1 : 18 | 0.0065 | 1.39 |
| E. M | 59 | 7.03 | 0.450 | 1 : 15 | 0.0076 | 1.25 |
| J. B | 60 | 7.26 | 0.398 | 1 : 18 | 0.0066 | 1.41 |
| W. E. C | 58 | 8.17 | 0.379 | 1 : 21 | 0.0065 | 1.23 |
| W. F. S | 60 | 8.39 | 0.647 | 1 : 13 | 0.0107 | 1.32 |
| J. J. B. S | 53 | 7.13 | 0.416 | 1 : 17 | 0.0078 | 1.24 |
| J. D. H | 71 | 8.19 | 0.488 | 1 : 18 | 0.0068 | 1.42 |
| C. J. F | 72 | 7.84 | 0.642 | 1 : 12 | 0.0089 | 1.58 |
| I. C | 62 | 8.05 | 0.512 | 1 : 15 | 0.0082 | 1.28 |
| M. D. L | 59 | 7.38 | 0.372 | 1 : 19 | 0.0063 | 1.28 |
| B. Z | 55 | 8.25 | 0.457 | 1 : 18 | 0.0083 | 1.19 |
| B. B | 65 | 8.08 | 0.387 | 1 : 20 | 0.0059 | 1.23 |
| C. P. D | 57 | 8.16 | 0.414 | 1 : 20 | 0.0072 | 1.42 |

The group of athletes reduced their proteid metabolism in such degree that the amount of nitrogen excreted daily during the period (four to five months) of the experiment averaged 8.8 grams, at the same time maintaining nitrogenous equilibrium. The table, which follows, shows the average daily excretion through the urine for a period of from four to five months.

STUDENT GROUP.

| Subject. | Body weight. Kilos. | Total nitrogen. Grams. | Uric acid. Gram. | Ratio of uric acid to nitrogen. | Uric acid per kilo of body weight. Gram. | Phosphoric acid ($P_2O_5$.) Grams. |
|---|---|---|---|---|---|---|
| G. W. A | 71 | 9.37 | 0.632 | 1 : 14 | 0.0089 | 1.75 |
| W. L. A | 61 | 10.41 | 0.516 | 1 : 20 | 0.0084 | 2.14 |
| H. S. B | 78 | 8.88 | 0.531 | 1 : 16 | 0.0068 | 1.98 |
| W. H. C | 83 | 9.04 | 0.624 | 1 : 14 | 0.0075 | 1.74 |
| M. D | 62 | 7.47 | 0.395 | 1 : 19 | 0.0063 | 1.79 |
| C. S. J | 56 | 7.58 | 0.423 | 1 : 17 | 0.0075 | 1.67 |
| H. R. S | 73 | 10.09 | 0.624 | 1 : 16 | 0.0085 | 2.20 |
| J. S | 75 | 11.06 | 0.699 | 1 : 16 | 0.0093 | 2.64 |

A perusal of the above tables will show that with all three classes of men about the same amount of uric acid per kilo of body weight was excreted and to this point the author pays particular attention in his discussion of the results of investigation. The general conclusion drawn from the research is that man living under the ordinary conditions of life and doing the ordinary

amount of mental or physical work is able to maintain bodily and mental health and vigor as well, if indeed not better, on a minimum proteid diet than on a diet containing proteid in amounts in agreement with the generally accepted dietary standards.

F. P. UNDERHILL.

**The Production of Fat from Proteid by the Bacillus Pyocyaneous.** BY S. P. BEEBE AND B. H. BUXTON. *Am. J. Physiol.*, 12, 466–471.—The *Bacillus Pyocyaneous* grown upon meat extract broth and peptone gives rise to a thick wrinkled pellicle on the surface of the fluid. This pellicle when extracted with chloroform and purified yields a yellow-brown residue soluble in ether. About 10 grams of substance were obtained from 30 liters of broth culture. This substance, which has the properties of a fat, was subjected to chemical examination with the following results: Melting point = does not have a sharp melting point, nor does it become fluid at 70° as do ordinary fats. Instead, it becomes thick and syrupy. Acid number = 47. Saponification value = 94. Iodine number = 70. On saponification 78 per cent. was non-saponifiable—and this portion had the properties of an alcohol. The origin of the fat is of special interest since the quantity of fat and of carbohydrates present in the nutrient medium is insufficient to account for the yield of fat. The carbohydrate nucleus of the proteoses and peptones present is also insufficient to account for the yield of fat. It seems probable, then, that the fat is found, in part at least, by oxidation of fragments of the proteoses and peptones.

F. P. UNDERHILL.

**On the Autolysis of Yeasts and Bacteria.** BY LEO F. RETTGER. *J. Med. Research*, 13 (New Series 8) 79–93.—Brewers' yeast undergoes autolysis when left to itself, whereby both the carbohydrate and proteid material are transformed into their respective decomposition products. This autolytic process is hastened by the use of a weak antiseptic and by increased temperature. If the autolysis is interrupted at the right stage, the intracellular proteid may be obtained and purified by filtration and subsequent coagulation. The proteid so obtained has the properties of ordinary albumins, although it is less stable than the albumins of animal origin. Bacteria also undergo autolysis, yielding among other things leucin, tyrosin, basic digestion products, and phosphoric acid. This process may go on in the living, growing cultures, especially if the medium contains very little proteid. It is hastened by means of a weak antiseptic and increased temperature. Under very favorable conditions complete digestion may occur in the course of but a few days (two-ten). During this process there is a liberation of the intracellular material, which may be obtained by filtration, coagulation, etc., as in the case of the yeast.

F. P. UNDERHILL.

**The Changes in the Viscosity of the Blood Produced by Alcohol.** By R. Burton-Opitz. *J. Physiol.*, **32**, 8–18.—The viscosity-values forming the basis of this paper were obtained by the method of Hürtle (*Arch. f. d. ges. Physiol.* **82**, 415). The experiments were carried out upon dogs and it is shown that small quantities (10–20 cc.) of distilled water, when introduced intravenously, render the blood more viscous, while equal quantities of 0.7 per cent. sodium chloride solution causes an immediate and very distinct decrease in the viscosity of the blood. Alcohol, whether introduced directly into the circulation, or into the digestive tract (stomach or duodenum) always rendered the blood more viscous. The greatest increase appeared when the alcohol was injected into the stomach or duodenum.

F. P. Underhill.

**The Influence of Suprarenal Extract upon Absorption and Transudation.** By S. J. Meltzer and John Auer. *Am. J. Med. Sci.*, **129**, 114–129.—For abstract see This Journal, **26**, R, 497.

**The Effect of Bile upon the Ester-splitting Action of Pancreatic Juice.** (A Preliminary Communication.) By Albion Walter Hewlett. *Johns Hopkins Hospital Bulletin*, **16**, 20–21.—The pancreatic juice employed in these experiments was obtained from dogs by means of secretin injections or by injections of both secretin and pilocarpin. Pancreatic juice thus obtained acts much more vigorously upon ethyl butyrate, triacetin and emulsions of olive oil in the presence of bile than it does alone. The accelerating action of the bile for pancreatic juice is not due to an enzyme in the former, but it is probable that the beneficial influence is due to the presence in the bile of small quantities of lecithin. Lecithin, itself, has a similar accelerating action upon the ester-splitting action of pancreatic juice.

F. P. Underhill.

**The Effect of Suprarenal Preparations on Living Protoplasm.** By Beaman Douglass. *Am. J. Med. Sci.*, **129**, 98–114.—Adrenaline solutions in the strength of 0.001 interfere with the clotting of blood of some cold-blooded animals (Asterius and Limulus), but in other animals there is no change. Arbacia spermatozoa when brought into solutions of 0.0001 adrenaline die within two hours. The effect appears to be similar to an agglutination phenomenon. Adrenaline has a very marked effect upon developing arbacia eggs, the effect varying with the strength of the adrenaline solution. Adrenaline also exercises a marked influence upon ciliated cells. Experiments with the hearts of the turtle and frog show that adrenaline solutions are powerful muscle stimulants.

F. P. Underhill.

**A Comparative Study of the Blood Corpuscles of Vertebrates.** BY ERNEST LINWOOD WALLUR. *J. Med. Research*, 13 (New Series 8), 61-79.—This paper is devoted wholly to the red corpuscles, and is based upon the study of the blood and red bone marrow of twenty-eight different species, which include all the chief subgroups of vertebrates, except the prototheria. The author distinguishes six distinct types of red corpuscles in the blood of vertebrates. These types are connected by transitional forms which present every possible gradation between these types. The development of the red corpuscles in mammals has also been considered. F. P. UNDERHILL.

**The Effect of Severe Hemorrhage on the Number of Blood Plates in Blood from the Peripheral Circulation of Rabbits.** BY F. L. RICHARDSON. *J. Med. Research*, 13 (New Series), 99-105.—After a considerable hemorrhage (appearance of physiological effects) in rabbits there is a marked increase in the number of blood plates in blood from the peripheral circulation, and this increase reaches its maximum on the fourth day after the bleeding. This evidence is consistent with the theory that the blood plate is formed in the process of the formation of the erythrocyte.

F. P. UNDERHILL.

**The Influence of Cholic Acid upon the Excretion of Sulphur in the Urine.** BY CARL L. ALSBERG. *J. Med. Research*, 13 (New Series 8) 105-111.—Cholic acid, when fed daily to cats in doses of about 0.13 gram per kilo of body weight, increases the excretion of neutral sulphur. This increase develops slowly, and is due in part to an increased proteid catabolism (as evidenced by an increased elimination of nitrogen) which it outlasts.

F. P. UNDERHILL.

**The Toxic and Antitoxic Action of Salts.** BY A. P. MATHEWS. *Am. J. Physiol.*, 12, 419-444.—The experiments show that the interpretation of the antitoxic action of one salt upon another, as given by Loeb, is incorrect, at least in part. Mathews shows that the toxic action of any salt bears no definite relationship to the valence of either ion, but is related to the decomposition tension of the salt. The toxic action is due to both ions equally. The antitoxic action must, hence, involve both ions. The antitoxic action of the salts of the bivalent metals for the salts of the univalent metals involves all ions, both of the antitoxin and the toxin, and is not due to an antitoxic action between different cations of different valence. Valence either of the anion or the cation is of secondary importance in determining either the toxic or the antitoxic action of the salts. It appears probable that several different causes may operate in determining antitoxic action, such as that the antitoxic salt increases the permeability of the cell-membranes, thus relieving the cell from plasmolysis

injuries; in other cases the cell-membrane is rendered less permeable to a given ion, thus protecting the protoplasm within from its influence. F. P. UNDERHILL.

**Further Evidence of the Nervous Origin of the Heart-Beat in Limulus.** BY A. J. CARLSON. *Am. J. Physiol.*, **12**, 471–499. —A continuation of the work by Carlson (*Am. J. Physiol.*, 12, 67) in which the heart beat in Limulus was shown to be of nervous origin. In the present paper, additional evidence is brought forward in support of this statement, and it is shown that inorganic salts, particularly sodium chloride, in solution, exert an action on the ganglion cells of the heart of the same nature as that exerted on the muscle, except that they act more rapidly in the former case. An isotonic solution of sodium chloride stimulates the ganglion practically instantaneously, while the heart from which the nerve-cord has been removed develops a more or less rhythmical series of contractions only after a prolonged (thirty–forty-five minutes) immersion in the solution. Calcium chloride counteracts the stimulating effects of the sodium chloride both on the ganglion and on the muscle. The combination of salts in the blood or in the sea-water does not produce contractions of the heart after the nerve-cord has been removed. F. P. UNDERHILL.

**The Quantitative Estimation of Carbamates.** BY J. J. R. MACLEOD AND H. D. HASKINS. *Am. J. Physiol.*, **12**, 444–457.— In this article a method is given for the quantitative estimation of the carbamates in blood or other fluids. The principle of the method is as follows: The carbon dioxide gas in 1 cc. of the fluid under examination is estimated in the apparatus of Barcroft and Haldane (*J. Physiol.* **28**, 232), the temperature of the water-bath being noted on a delicate thermometer. Another cubic centimeter of the fluid is vigorously shaken in a stoppered weighing-bottle with an excess of a saturated watery solution of barium hydroxide containing ammonia. This causes complete precipitation of the carbonates, but not the carbamates, as the barium salt of these is soluble in water. After one-half hour the fluid is transferred to a tube, which is tightly corked and centrifuged, and the carbon dioxide gas determined (at the same temperature as that used for total carbon dioxide), either in the supernatant fluid or in the precipitate; in the supernatant fluid when blood or other fluids rich in proteids are under examination; in the precipitate in other cases. The gas found in the supernatant fluid corresponds to that of the carbamates. The difference between the amount of gas found in 1 cc. of the total fluid, and that found in the precipitate, also corresponds to the gas of the carbamates. F. P. UNDERHILL.

**The Influence of Fever on the Reducing Action of the Animal Organism.** BY C. A. HERTER. *Am. J. Physiol.*, **12**, 457–466.—

Rabbits, in which the temperature has been elevated by artificial means (contact with heat), and by injections of cultures of hog-cholera, when intravenously infused with a 0.25 per cent. methylene blue solution are more capable of reducing the methylene blue to the leuco-methylene blue than are animals whose temperature is normal. F. P. UNDERHILL.

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## PHARMACEUTICAL CHEMISTRY.

**Home-made Extraction Apparatus.** BY F. N. STRICKLAND. *Merck's Rep.*, 13, 355.—A description and illustration of an easily made apparatus for continuous extraction, working on the same general principle as the Soxhlet extraction apparatus.

**Granular Effervescent Salts.** BY E. F. COOK. *Pract. Drug.*, 16, 441.—The medicinal substance is mixed with citric and tartaric acids and sodium bicarbonate and placed in a porcelain-lined steam-jacketed kettle and heated. In this way advantage is taken of the one molecule of water of crystallization of the citric acid to moisten the entire mixture sufficiently to allow of being forced through a coarse sieve and still retain the form thus given it. The moist granules are then dried in hot-air closets.

The following new method is proposed: The mixed ingredients of the preparation are placed upon a warmed glass plate and placed in an ordinary drying oven previously heated to 93° C. and left there for one minute, when the entire mass will be uniformly and sufficiently moist to be passed through a tinned-iron sieve and still retain its form. The granular powder is then completely dried on the top of the oven. In this way ten pounds or more can be granulated in an hour. W. H. BLOME.

**Federal Control of Drugs.** BY H. W. WILEY. *Pharm. Era*, 32, 633.—Drugs brought into the United States from foreign countries are judged by the pharmacopoeias and standards of those countries. Even patent medicines must be examined and passed upon for their general fitness for use as medicines. Such examinations are made under the directions of the Treasury Department. The Department of Agriculture aims to investigate the adulteration and false labeling of foods, condiments, beverages and drugs. The new Drug Laboratory concerns itself exclusively with the examination of suspected drugs and chemicals. Through the agency of the Drug Laboratory a number of fraud orders have been issued excluding certain nostrums and their advertisements from the mails. W. H. BLOME.

**New Remedies of 1904.** *Merck's Rep.*, 14, 17.—The activity of chemists during the past year in the preparation of synthetic remedies has not slackened very materially. This fact is proven

by a list of about 240 remedies, which is probably by no means complete, all of which came into being last year. The name is accompanied by a brief description of the substance, its medicinal uses and dose.

W. H. BLOME.

**Tests for the Purity of Cod-liver Oil.** BY E. H. GANE. *Merck's Rep.*, 14, 10.—Special attention is again called to the value of the nitric acid test for cod-liver oil. Two drops of acid are added to fifteen drops of the suspected oil. The rose-pink color changes rapidly to lemon-yellow, which persists for many hours. This test is not given by any of the substitutes or adulterants of cod-liver oil. The mixture of nitric and sulphuric acids frequently recommended does not give such good results, since the change of color is entirely obscured. The amount of free acid present in the oil is of considerable importance in a medicinal oil; the best samples contain 1 per cent. or less. The percentage of free acid is ascertained by titrating an alcoholic solution of a weighed sample of oil with a standard alkali solution. It has been suggested that the refraction index of an oil might aid in determining its purity, but the author has not found it to be of much service.

W. H. BLOME.

## SANITARY CHEMISTRY.

**Examination of Sewer Outlets and the Effect of Sewage Disposal, 1893.** *Thirty-fifth Annual Report, Mass. State Board of Health, 1903*, pp. 305–455.—Of the 92 cities and towns of Massachusetts, four cities and nineteen towns—Amherst, Andover, Billerica, Brockton, Clinton, Concord, Framingham, Franklin, Gardner, Hopedale, Leicester, Lenox, Longmeadow, Marlborough, Maynard, Medfield, Natick, Pittsfield, Southbridge, Spencer, Stockbridge, Westborough, Worcester—employ some form of treatment for the removal of organic matter from the sewage, and the paper gives a detailed description of the sewage purification plants with method of operation, analyses of sewage and effluent at sixteen of these places, together with a general summary of the results obtained. The works at the smaller towns, Amherst, Billerica, Franklin, Lenox, Longmeadow, Maynard and Medfield are omitted, as being of comparatively little interest. Of the works now in operation, the oldest is at Medfield, constructed in 1886. The first works for the disposal of the sewage of a town of considerable size were constructed at Framingham in 1889. At practically all the sewage disposal works the ultimate method of purifying sewage is by intermittent filtration through gravel or sand, as soil of this character is found in nearly all parts of the State. The preliminary treatment consists, as a rule, of screening and sedimentation, only one town, Hopedale, using

septic tanks. Brockton, Clinton, Concord, Framingham, Natick and Pittsfield have large receiving reservoirs, holding more than a twelve-hour flow, from which the sewage is pumped, and Leicester a sedimentation tank holding over half the daily flow. At Gardner, Templeton plant, the sewage is passed through coke filters or strainers before being run upon the sand beds. The intermittent sand filtration beds were, as a rule, made by stripping the soil, dividing the underlying sand into beds from one-half to one acre superficial area. In only three cases, Gardner, the Templeton area, Westborough and Worcester, were the beds made by excavation and filled with sand obtained from neighboring knolls. At only five places is the area of the sand beds less than one-half an acre. Leicester 0.05, Gardner (Gardner area) 0.05 to 0.21, Andover 0.18, Gardner (Templeton area) and Southbridge 0.25. The beds, except in a very few cases, where the sand and gravel is very coarse, were underdrained, generally at the depth of from four to six feet, with drains about thirty feet apart, though at Clinton, Framingham and Southbridge each bed has only one drain running through the center of the bed. The method of working the filters differs at the different plants. At some a given amount of sewage is applied to each filter each day. At others the whole sewage for one or two days is applied to the same filter, and then the filter is allowed to rest for three or more days, while at Brockton and Clinton certain beds are reserved for the heavy sewage which is pumped from the bottom of the sewage reservoir each night and allowed to remain in the pipes over night, these beds acting more or less as sludge beds. As a rule the sewage is run upon a bed at such a rate that the whole bed is covered to a depth of a half inch or more with sewage, as otherwise there is more or less difficulty in obtaining good distribution of the sewage. In many places the beds are furrowed for winter work while at others the surface of the beds is left level, there being a difference of opinion as to whether or not any advantage is obtained by furrowing.

The following table, arranged from tables given in the report, gives the most essential data regarding sixteen of the seventeen plants described. The results are the average of monthly analyses made during the year 1903. The sewage, except in the cases of Clinton, Gardner and Pittsfield, may be considered as domestic sewage. Clinton sewage contains a large amount of wool washings, Pittsfield a certain amount of wool and cloth washings, and Gardner, often the refuse from a creamery. The results from the Worcester plant are not included in this table, the method being different from any of the towns or cities there given. The sewage of Worcester, about fifteen million gallons per day, differs from the sewage of any other place in Massachusetts, in containing a very large amount of ferrous sulphate and also free sulphuric acid. Part of the sewage is treated with lime, about one thousand

| City or town. | Total area of filter-beds (acres). | No. of beds. | Average amount of sewage per acre per day. | Residue on evaporation. Total residue. Total. | Residue on evaporation. Total residue. Suspended. | Residue on evaporation. Loss on ignition. Total. | Residue on evaporation. Loss on ignition. Suspended. | Ammonia. Free. | Ammonia. Albuminoid. | Nitrogen. Nitrites. | Nitrogen. Nitrates. | Oxygen consumed. | Chlorine. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ANDOVER.................. | 3.65 | 20 | 34,200 | | | | | | | | | | |
| Sewage .............. | | | | 46.65 | 10.33 | 24.39 | 8.62 | 4.82 | 0.68 | ...... | ...... | 4.90 | 7.00 |
| Effluent.............. | | | | 26.07 | ...... | ...... | ...... | 1.1040 | 0.0677 | 0.0161 | 0.8325 | 0.74 | 5.37 |
| Per cent. purification.. | | | | | | | | 77.1 | 90.0 | ...... | ...... | 84.9 | ...... |
| BROCKTON................. | 21.48 | 23 | 40,900 | | | | | | | | | | |
| Sewage ............... | | | | 121.00 | 57.90 | 75.80 | 50.40 | 5.32 | 1.57 | ...... | ...... | 21.85 | 13.27 |
| Effluent.............. | | | | 53.17 | ...... | ...... | ...... | 0.2250 | 0.0166 | 0.0103 | 3.0750 | 0.33 | 11.13 |
| Per cent. purification.. | | | | | | | | 95.8 | 98.9 | ...... | ...... | 98.5 | ...... |
| CLINTON.................. | 23.50 | 25 | 33,400 | | | | | | | | | | |
| Sewage ............... | | | | 94.94 | 22.19 | 47.84 | 15.50 | 4.04 | 0.96 | ...... | ...... | 11.37 | 5.95 |
| Effluent.............. | | | | 41.66 | ...... | ...... | ...... | 1.0173 | 0.0774 | 0.0199 | 0.4399 | 1.12 | 5.55 |
| Per cent. purification.. | | | | | | | | 74.8 | 91.9 | ...... | ...... | 90.1 | ...... |
| CONCORD .................. | 3.30 | 4 | 94,500 | | | | | | | | | | |
| Sewage............... | | | | 20.29 | 3.02 | 8.44 | 2.73 | 0.69 | 0.17 | ...... | ...... | 1.36 | 2.66 |
| Effluent.............. | | | | 17.56 | ...... | ...... | ...... | 0.0017 | 0.0104 | 0.0000 | 0.8467 | 0.11 | 2.59 |
| Per cent. purification.. | | | | | | | | 99.8 | 93.9 | ...... | ...... | 91.9 | ...... |
| FRAMINGHAM........... | 19.90 | 18 | 32,800 | | | | | | | | | | |
| Sewage............... | | | | 58.77 | 21.24 | 29.88 | 16.22 | 3.17 | 0.79 | ...... | ...... | 4.73 | 6.99 |
| Effluent.............. | | | | 28.51 | ...... | ...... | ...... | 0.2169 | 0.0186 | 0.0151 | 0.9854 | 0.26 | 5.17 |
| Per cent. purification.. | | | | | | | | 93.2 | 97.6 | ...... | ...... | 94.4 | ...... |
| GARDNER (Gardner system).................. | 2.50 | 21 | 120,800 | | | | | | | | | | |
| Sewage............... | | | | 38.37 | 15.40 | 22.93 | 13.04 | 2.45 | 0.60 | ...... | ...... | 4.92 | 3.38 |
| Effluent... ........... | | | | 23.48 | ...... | ...... | ...... | 1.7990 | 0.0841 | 0.0047 | 0.0442 | 1.07 | 3.02 |
| Per cent. purification.. | | | | | | | | 26.6 | 86.0 | ...... | ...... | 78.3 | ...... |

| City or town. | Total area of filter-beds (acres). | No. of beds. | Average amount of sewage per acre per day. | Residue on evaporation. Total residue. Total. | Residue on evaporation. Total residue. Suspended. | Residue on evaporation. Loss on ignition. Total. | Residue on evaporation. Loss on ignition. Suspended. | Ammonia. Free. | Ammonia. Albuminoid. | Nitrogen. Nitrites. | Nitrogen. Nitrates. | Oxygen consumed. | Chlorine. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GARDNER (Templeton system) | 2.25 | 9 | 111.100 | | | | | | | | | | |
| Sewage | | | | 43.06 | 20.18 | 26.97 | 17.76 | 3.31 | 0.80 | ...... | ...... | 6.03 | 4.38 |
| Effluent | | | | 25.69 | ...... | ...... | ...... | 0.7761 | 0.0698 | 0.196 | 1.5180 | 0.58 | 3.04 |
| Per cent. purification | | | | | | | | 76.6 | 91.3 | ...... | ...... | 90.4 | ...... |
| HOPEDALE | 2.30 | 4 | 65.200 | | | | | | | | | | |
| Sewage | | | | 19.67 | 5.10 | 10.43 | 4.34 | 2.22 | 0.34 | ...... | ...... | 2.98 | 2.23 |
| Effluent | | | | 23.39 | ...... | ...... | ...... | 1.0440 | 0.0888 | 0.0256 | 1.5856 | 0.72 | 2.49 |
| Per cent. purification | | | | | | | | 53.0 | 73.9 | ...... | ...... | 75.8 | ...... |
| LEICESTER | 0.36 | 8 | 83.300 | | | | | | | | | | |
| Sewage | | | | 42.17 | 14.01 | 22.05 | 11.73 | 2.67 | 0.50 | ...... | ...... | 5.08 | 5.47 |
| Effluent | | | | 23.67 | ...... | ...... | ...... | 0.7065 | 0.0813 | 0.0367 | 0.9117 | 0.96 | 3.94 |
| Per cent. purification | | | | | | | | 73.5 | 83.8 | ...... | ...... | 81.1 | ...... |
| MARLBOROUGH | 11.20 | 18 | 98.200 | | | | | | | | | | |
| Sewage | | | | 44.82 | 13.75 | 21.89 | 11.57 | 3.15 | 0.54 | ...... | ...... | 4.44 | 5.90 |
| Effluent | | | | 27.05 | ...... | ..... | ...... | 1.2365 | 0.0622 | 0.0272 | 0.3521 | 0.73 | 5.97 |
| Per cent. purification | | | | | | | | 60.7 | 88.5 | ...... | ...... | 83.6 | ...... |
| NATICK | 11.10 | 11 | 51.000 | | | | | | | | | | |
| Sewage | | | | 36.13 | 5.55 | 13.65 | 4.56 | 1.48 | 0.32 | ...... | ...... | 3.27 | 5.95 |
| Effluent | | | | 20.62 | ...... | ...... | ...... | 0.6150 | 0.0319 | 0.0195 | 0.2217 | 0.44 | 4.04 |
| Per cent. purification | | | | | | | | 58.4 | 90.0 | ...... | ...... | 86.5 | ...... |
| PITTSFIELD | 21.67 | 29 | 67.200 | | | | | | | | | | |
| Sewage | | | | 90.98 | 48.67 | 55.75 | 36.86 | 1.46 | 0.99 | ...... | ...... | 7.92 | 2.57 |
| Effluent | | | | 33.38 | ...... | ...... | ...... | 0.2626 | 0.0365 | 0.0198 | 0.6674 | 0.38 | 2.29 |
| Per cent. purification | | | | | | | | 82.0 | 96.3 | ...... | ...... | 95.2 | ...... |

| City or town. | Total area of filter-beds (acres). | No. of beds. | Average amount of sewage per acre per day. | Residue on evaporation. Total residue. Total. | Residue on evaporation. Total residue. Suspended. | Residue on evaporation. Loss on ignition. Total | Residue on evaporation. Loss on ignition. Suspended. | Ammonia. Free. | Ammonia. Albuminoid. | Nitrogen. Nitrites. | Nitrogen. Nitrates. | Oxygen consumed. | Chlorine. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SOUTHBRIDGE | 7.25 | 17 | 48.300 | | | | | | | | | | |
| Sewage | | | | 28.71 | 11.10 | 15.97 | 8.66 | 1.95 | 0.43 | ...... | ...... | 4.01 | 2.90 |
| Effluent | | | | 10.96 | ...... | ...... | ...... | 0.3865 | 0.0369 | 0.0126 | 0.2036 | 0.36 | 1.74 |
| Per cent. purification | | | | | | | | 80.2 | 91.4 | ...... | ...... | 91.0 | ...... |
| SPENCER | 9.30 | 12 | 40.300 | | | | | | | | | | |
| Sewage | | | | 35.78 | 11.44 | 20.22 | 10.16 | 1.81 | 0.55 | ...... | ...... | 4.65 | 3.99 |
| Effluent | | | | 17.95 | ...... | ...... | ...... | 0.1484 | 0.0186 | 0.0248 | 0.3691 | 0.33 | 3.16 |
| Per cent. purification | | | | | | | | 91.8 | 96.6 | ...... | ...... | 92.9 | ...... |
| STOCKBRIDGE | { 1.00 2.60 } | 4 | 20.800 | | | | | | | | | | |
| Sewage | | | | 23.56 | 4.05 | 8.80 | 3.09 | 1.19 | 0.20 | ...... | ...... | 1.52 | 1.28 |
| Effluent | | | | 19.95 | ...... | ...... | ...... | 0.0990 | 0.0207 | 0.0025 | 0.1630 | 0.30 | 1.81 |
| Per cent. purification | | | | | | | | 91.6 | 89.6 | ...... | ...... | 79.9 | ...... |
| WESTBOROUGH | 4.00 | 7 | 70.500 | | | | | | | | | | |
| Sewage | | | | 37.01 | 18.33 | 21.30 | 13.69 | 1.68 | 0.54 | ...... | ...... | 3.55 | 2.37 |
| Effluent | | | | 15.54 | ...... | ...... | ...... | 0.6410 | 0.0849 | 0.0528 | 0.3571 | 0.73 | 2.22 |
| Per cent. purification | | | | | | | | 61.8 | 84.3 | ...... | ...... | 79.4 | ...... |

pounds to the million gallons, in the form of milk of lime and passed through settling tanks, time of flow eight hours, and is then as far as possible carried upon intermittent filtration beds for final treatment, what cannot be treated this way being run directly into the river. The portion of the sewage that is not treated with lime is passed through sedimentation basins, eight hours' flow, and then upon intermittent filtration beds. The number of beds at Worcester is twenty-three, each of an acre area, underdrained by lines of pipe 50 feet apart, laid from 4 to 6 feet beneath the surface. The amount of purification accomplished, judging by the albuminoid ammonia, is from the lime treatment 50 per cent., from lime treatment and intermittent filtration 84 per cent. in 1902, from sedimentation and intermittent filtration 75 per cent. in 1901.

Of the sixteen plants included in the above table the amount of albuminoid ammonia in the effluent at eight plants is less than 0.04 part per 100,000, while in the least satisfactory effluent, that of Hopedale, the amount is only 0.088. As regards Hopedale, the only important respect in which the method there used differs from the method used in other places is that the sewage, before being applied to the beds, is passed through a septic tank. The changes wihch take place in this sewage, in the septic tank, as there used, are apparently unfavorable to its thorough purification, when it is applied directly without aeration to the intermittent sand filters.

Next to Hopedale, the effluents of poorest quality are at Westborough, Gardner (Gardner area), and Leicester. At Westborough this is probably due to uneven distribution of the sewage on the beds, and to the fact that the sewage is allowed to run upon the same beds for weeks at a time. At Gardner (Gardner area) the conditions are similar to those at Westborough, in that the sewage runs upon the beds continuously for many weeks, allowing no opportunity for air to enter the beds, and also to the fact that the excessive amount applied, 120,000 gallons per day, is beyond the capacity of the beds. At Leicester, the conditions somewhat resemble those at Hopedale in that the sedimentation tank holds about a twelve-hour flow of sewage, and being seldom emptied acts much of the time as a septic tank.

As regards the permanency of sand intermittent filters, the report states: "The results on the whole show that slight deterioration is taking place in those filters which are overdosed and is due to the clogging of the surface sand with organic matters, especially fats. If this condition should continue, the time may come when it will be necessary to remove a few inches of sand from the surfaces of these filters. It is not certain, however, that such removal would be necessary, especially if overdosing should be discontinued."

LEONARD P. KINNICUTT.

**Report of an Examination of Sewage Purification Plants in Ohio.** BY R. WINTHROP PRATT. Advance sheets from the Eighteenth Annual Report, Ohio State Board of Health, 1903, pp. 1-110.—The report gives a description, accompanied by cuts and half-tones, analyses of sewage and effluent of the sewage purification plants in operation in Ohio in 1903. Sewage purification in Ohio, as elsewhere in this country, is of recent date. The first plant built in the State was at Oberlin in 1893. In 1898 there were seven plants in operation, and in 1903 twenty-six, while eighteen more were being planned or constructed. Of the twenty-six plants in operation in 1903 twelve were used for the treatment of the sewage of cities or villages, the others for the sewage of institutions. Four—Alliance 500,000 gallons sewage daily, Canton 2,500,000 gallons, Glenville 500,000 gallons, Oberlin 100,000 gallons—used chemical treatment as the method of purification, the first three using lime, and Oberlin aluminum sulphate. At Glenville the effluent from the chemical precipitation tanks is passed upon coke contact beds which are used, not as contact beds, but as filters. The results obtained at Glenville may be said to be fairly good, while at the other three cities the results are decidedly poor. The remaining eight cities or villages used bacterial methods. Three used intermittent filtration. Clyde 100,000 gallons, intermittent filtration without previous treatment, and only run from April to December. Results obtained, owing to lack of supervision, very poor. Fostoria, 400,000 gallons, storage reservoirs, 450,000 gallons capacity, two intermittent one-acre sand filtration beds, four one-acre of underdrained clay beds, and about fourteen acres of irrigation beds. Results poor, and if it was not for the two sand beds, the plant would be an utter failure. Shelby, 250,000 gallons, two sedimentation tanks each 8,000 gallons capacity, reservoir holding some five days' flow of sewage, two cinder filters, total area 0.6 acre, sewage allowed to flow on one bed for two or three weeks at a time. Results poor. The large storage reservoir was constructed in order to give the iron that is in the sewage time to oxidize and precipitate, but very little oxidation takes place. Five towns use septic tanks and contact beds. Delaware, 100,000 to 200,000 gallons, two septic tanks, one 45,000 gallons capacity, the other 90,000 gallons, three contact beds each 110 feet square on surface, filled with three feet of fine coke with a three-inch layer of gravel on top. Poor results owing to want of attention. Kenton, 25,000 gallons, septic tank 21,000 gallons capacity; three flushing filters five feet by ten feet, two feet deep, filled with a mixture of charcoal, coke, and limestone, ranging from one-half to three inches in diameter. Three wave contact beds, ten feet by one hundred feet, filled with layer of pea coke, eighteen inches deep at the upper end, one inch at the lower. The coke is covered with broken stone. Though very little care is given to the plant, it works fairly well.

Mansfield, 1,000,000 gallons. Four septic tanks, each holding 250,000 gallons, five contact beds, each one-fourth acre area, containing five feet of furnace cinders. Results good. Westerville, 20,000 to 25,000 gallons sewage, largely creamery waste. Two septic tanks, each of 12,500 gallons capacity, aerating steps having a fall of 2.5 vertical feet, six contact beds, each containing three feet of screened cinders, one-eighth to one-inch in diameter. Up to 1904 only three of these beds had been used. Results good. East Cleveland, dry weather flow 400,000, but during several months of the year 1,400,000. Septic tanks, aerated primary and secondary filters, and contact beds. The septic tank has a capacity of 170,000 gallons. The primary filters consist of masonry tanks each 6,000 square feet in area, filled with 2.5 feet of coarse slag, of egg coal size The slag is placed upon inverted half-tile pipe with open joints resting on bucks on the concrete floor of the tanks. This forms a large open space, through which the sewage flows to a core wall so constructed that the flow is directed upward between a first and second wall over the top of the second wall in a thin film, downward between the second and third walls and then upward through the coarse material of the secondary filters. These secondary filters are similar in construction to the primary filters and so arranged that each receives the effluent from two primary filters. The aerators which are really contact beds, consist of a set of two filters each divided superficially into four areas twenty by seventy feet, having a false floor of inverted half sections of tile pipe upon which the following material is placed: Six inches coarse broken stone, four feet of pea coke, six inches of broken stone, and four inches of coarse sand. The important feature of the plant and that which makes possible the high rate of filtration used is the aerating system, by means of which air is continuously forced into the open spaces beneath the aerators and also to the primary and secondary filters. Short lengths of pipe pierce the sand covering the aerators and allow the escape of air and other gases which rise through the coke and broken stone. The air blast also serves to hold the sewage in contact with the filling material for a longer time. Results good. The methods used by the various institutions named in the paper are all bacterial methods. Two use broad irrigation; one intermittent filtration without previous treatment; one intermittent filtration with broad irrigation; four flush tanks and intermittent filtration; four septic tanks and intermittent filtration; one septic tank and contact beds. The results obtained are very much better than is the case with the towns and villages, owing to proper care and attention. Only two of these plants, one having broad irrigation, and the other broad irrigation and intermittent filtration, can be said to give decidedly poor results.

LEONARD P. KINNICUTT.

**Bacterial Counts of Boston Milk Supply.** H. W. HILL AND F. H. SLACK. *American Journal of Public Hygiene*, **15**, 236-248.—On April 29, 1904, the following regulation in regard to the milk supply was adopted by the Boston Board of Health: "No person by himself or by his servant or agent, or as the servant or agent of any other person, firm or corporation, shall bring into the City of Boston for purpose of sale, exchange or delivery, or sell, exchange, or deliver any milk, skimmed milk, or cream which contains more than 500,000 bacteria per cubic centimeter or which has a temperature higher than 50 deg. F." From the first of June samples have been continuously taken, for the most part from milk as it arrives in the city, the milk as delivered to private houses or sold from stores or restaurants not as yet having received very much attention. In all 2,394 samples were analyzed. As to temperature 53.25 per cent. were below 50° F., the law limit, 46.75 per cent. above 50° F., 39.50 per cent. were between 50° and 60° and only 7.25 per cent. above 60°.

The bacterial counts were as follows:

| Month. | No. of samples taken. | Below 100,000. Per cent. | Between 100,000 and 500,000. Per cent. | Between 500,000 and 1,000,000. Per cent. | Between 1,000,000 and 5,000,000. Per cent. | Above 5,000,000. Per cent. | Uncountable spreaders. Per cent. | Below law-limit. Per cent. | Above law limit. Per cent. |
|---|---|---|---|---|---|---|---|---|---|
| June | 539 | 49 | 23 | 7.5 | 13 | 5.5 | 2 | 72 | 26 |
| July | 620 | 29 | 33 | 12 | 15 | 10.5 | 0.5 | 62 | 37.5 |
| August | 626 | 46 | 31 | 9 | 11 | 2.5 | 0.5 | 77 | 22.5 |
| September | 609 | 45.5 | 30.5 | 10.5 | 12 | 1.5 | ... | 76 | 24 |
| Totals, | 2,394 | 42 | 29.75 | 9.75 | 12.75 | 5 | 0.75 | 71.75 | 27.50 |

For media 1½ per cent. nutrient agar (B.C.) 10 cc. to a tube, with reaction plus 0.7 was used. In plating the samples the standard dilution of the milk was 1 to 10,000. One cubic centimeter of this dilution was delivered into a Petri dish and 10 cc. of the melted agar, and at a temperature between 40° and 45° C. added. The plates were incubated in a saturated atmosphere at 37° C., for twenty-four hours. The twenty-four-hour incubation was used in preference to the forty-eight-hour period because, although the latter showed a slightly higher average count, the counts were not sufficiently higher to materially change the report, and it lessened the danger from spreaders. The danger from spreaders in the twenty-four-hour plates is now overcome by earthenware Petri covers first suggested by Hibbert W. Hill (*J. Med. Research*, Nov., 1904).

LEONARD P. KINNICUTT.

## INDUSTRIAL CHEMISTRY.

**Materials for Resistors.** By F. A. J. Fitzgerald. *Elec. Chem. Ind.*, December, 1904.—The author refers to the substance offering resistance to the passage of the electric current by the name of Resistor, while the property of this substance is Resistance.

In some cases the conductance does not vary appreciably with increase of heat, but in the cases of carbon resistors two factors may enter; first, an increase of conductance, which rises to double the original value; second, increase due to the change in the carbon to graphite, which conductance becomes four times that of the amorphous carbon. The total increase is thus eight.

The author illustrates the phenomenon of the increase in conductance and density, and decrease in susceptibility to oxidation by describing an experiment in which a "soft" carbon rod is encased in an iron tube to serve as a protector. One end which is heated to the highest attainable temperature in an electric furnace. It was noticed that the density of the rod decreased and the resistance increased continually from the heated end.

In order not to have a permanent change in a resistor, after being heated, in practice, it is recommended to heat it to the maximum temperature that it will have to stand before using.

Although different forms of carbon may be graphitized, the resulting products differ considerably, as shown herewith:

Two carbon electrodes were placed side by side in the electric furnace. One of these electrodes was made of the purest lampblack carbon, the other of petroleum coke, with the addition of about 2 per cent. of ferric oxide. After removal from the furnace the electrodes were compared, with the following results:

| Lampblack Electrode. | Petroleum Coke Electrode. |
|---|---|
| Does not show any of the ordinary evidences of graphitization. The color of the carbon is unchanged, and it is still hard and brittle when an attempt is made to cut it with a knife. It will scarcely mark paper, and will not take a brilliant polish when rubbed. | Has brilliant graphitic appearance. Can be readily cut with a knife. Takes a brilliant polish when rubbed. Marks paper like a pencil. |
| *Density 2.05.* | *Density 2.20.* |
| When used as an anode in electrolyzing a solution of sulphuric acid the disintegration is very rapid. | When used as an anode in electrolyzing a solution of sulphuric acid the disintegration is much slower than in the case of the lampblack electrode. |
| Burns with comparative ease when heated to bright redness in the air. In quantitative test it was found that the rate of oxidation was nearly 100 per cent. greater than that of the petroleum coke electrode. | Burns with difficulty when heated to bright redness in the air. |
| Treated with the oxidizing mixture of potassium chlorate and nitric acid the specimen was converted into graphitic oxide. | Treated with the oxidizing mixture of potassium chlorate and nitric acid, the specimen was converted into graphitic oxide. |

The author recommends broken pieces of carbon for resistors for large scale work, as carbon rods necessitate currents of great amperage and low voltage, and calls attention to the fact that pressure affects the conductance, this being greater with increase of pressure.

With reference to resistors, and the conclusions to be drawn from this experiment, the author summarizes as follows:

(1) When the current is started there is first a rapid decrease in the resistance of the resistor, followed by a slow increase. Although the present experiment does not show it, this increase is followed by a decrease if the conditions are such that radiation of heat from the resistor is prevented and its temperature continues to rise.

(2) Other things equal, preventing the radiation of heat from a carbon resistor causes a decrease in its resistance.

(3) If pressure is applied to the resistor, the resistance decreases, and after removing the pressure the resistance is lower than it was before applying pressure.

(4) Of two granular carbon resistors, each composed of grains of uniform size, the coarser-grained resistor has the lower resistivity.

(5) If the same pressure is applied to a coarse-grained and fine-grained resistor the decrease in resistivity produced is greater in the former than in the latter. All of these conclusions are of importance in practical work where a granular carbon resistor is used. As was shown before, it is important to have some means of regulating the applied electromotive force in order to compensate for the change in resistance. S. P. Sadtler.

**Flame Regulation in Chemical and Metallurgical Operations.** By Carleton Ellis. *Elec. Chem. Ind.*, December, 1904.—The Eldred process is designed to effect a simultaneous regulation and control of the duration of combustion and the temperature and volume of the flame in technical work.

The heat can be made to uniformly fill any desired space or be localized, and may be generated at a relatively low temperature. The author states it can be made so low as not to burn wood.

The process consists in drawing a portion of the flue gases down by means of a fan and passing them with a regulated amount of fresh air through the grate for the combustion of the fuel. The dilution of the air gives greater duration to the flame, so that the effect is not felt in largest measure in a restricted zone near the grate bars. With proper regulation the fuel bed is cooler than with a pure air draft, as the combustion is retarded.

The following table shows the progressive changes in the character of the entering and escaping gases. The nitrogen remains practically constant, namely, at 79 per cent., so it need not enter into the calculations.

| Interval of time. | Gas discharged at top of kiln. Oxygen. Per cent. | Carbon dioxide. Per cent. | Gas-air mixture entering at E. Oxygen. Per cent. | Carbon dioxide. Per cent. |
|---|---|---|---|---|
| 0 | 15.0 | 6.0 | ...... | ...... |
| 1 | 12.0 | 9.0 | 18.0 | 3.0 |
| 2 | 10.5 | 10.5 | 16.5 | 4.5 |
| 3 | 9.75 | 11.25 | 15.75 | 5.25 |
| 4 | 9.38 | 11.63 | 15.38 | 5.63 |
| 5 | 9.19 | 11.81 | 15.19 | 5.81 |
| 6 | 9.09 | 11.91 | 15.09 | 5.91 |
| The limiting values therefore are: | 9.0 | 12.0 | 15.0 | 6.0 |

Or, in other words, the application of such a cyclic process, starting with stack gases carrying 6 per cent. of carbon dioxide and continuously diluting these with an equal volume of air (calculated at the same temperature) would cause the percentage of carbon dioxide in the stack gases to increase to 12 per cent., or double its normal amount, and the oxygen would be reduced to 9 per cent., or the excess of air expressed in percentage of that chemically combined would be reduced from about 250 per cent. to approximately 75 per cent. excess, a difference of 175 per cent. In many furnaces 80 per cent. of the heat generated is carried away in escaping gases. Could such a case as above described be carried out in practice, the reduction in the excess air by 175 per cent. would be equivalent to an increase in fuel efficiency of about 40 per cent. The variable nature of the fire, among other things, in practice does not, of course, permit of an adjustment so effective that the above conditions can be realized. Besides, the Eldred process uses to advantage a smaller fraction of the stack gases than that above mentioned.

According to the theory of limits, equilibrium in this system is never attained, but actually it is quickly reached so far as can be shown by analysis of the gases at different points.

Not only is less oxygen present by volume than in ordinary air, but less is actually used.

The process is said to be in successful operation in billet-heating and annealing furnaces; lime, cement and brick kilns; ore roasting and reverberatory furnaces; and its use is likely to be extended to puddling and rolling mills, for ceramic work, etc. The author states that a recent modification makes it applicable for the heating of steam boilers.

In lime burning as high as 5.25 pounds of lime per barrel of coal have been obtained. The output of the kilns may be increased 50 per cent. over other methods, as there is no danger of overburning and the heat is carried further by conversion. Savings are also effected in rolling-mill work, cement, brick burning, etc., as indicated above. A very promising field will probably be in ore-roasting when the desired result will be brought about more expeditiously and surely.

S. P. Sadtler.

**The Valuation of Coal for Steaming Purposes.** *The Chemical Engineer*, November, 1904.—The author states that the heating values of coals may be determined by calculation from the results of elementary analysis, from proximate analysis and by direct determination in a calorimeter. For calculation from the proximate analysis the DuLong and Haas formulas are referred to, the latter being based on a coal with a certain percentage of hydrocarbons and oxygenated constituents. Formula: Calorific power (B. T. U. per 100 pounds) = 15,675 × (100 per cent. ash, — per cent. sulphur, — per cent. moisture, + 4,050 × — per cent. sulphur. It is only claimed to be useful for rough heat calculations.

CLASSIFICATION OF COALS.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Anthracite............ | below 8 | per | cent. | of | volatile | combustible | matter. |
| Semi-anthracite....... | 8–13 | " | " | " | " | " | " |
| Semi-bituminous...... | 13–25 | " | " | " | " | " | " |
| Bituminous............. | 25–40 | " | " | " | " | " | " |
| Cannel............. | above 40 | " | " | " | " | " | " |

The tendency of coal to produce smoke increases with the volatile matter it contains. It is stated that the loss due to smoke is generally insignificant, but where a plain grate bar furnace is used a fire-brick arch should be used to secure a hot combustion chamber, with coal containing over 20 per cent. of volatile matter, and the best method is to use pulverized fuel.

The author suggests the *striking of a balance* from the results of analysis of a coal in which the coal is charged with its heat capacity and credited with the heat required to evaporate the moisture contained (1,200 B. T. U. per pound of water to stack temperature, instead of 966 to steam at 212°) and the heat carried off in the ash as unconsumed carbon (the percentage of carbon in the ash based on the original weight of coal × 14,540) the balance being effective for heating purposes.

With regard to sampling the following is quoted:

"If the coal to be sampled is in a car, a good plan is to go down the middle of the car taking a scoop-shovel full every yard from end to end by driving the shovel down vertically and bringing out all the coal it will hold. Then go across the middle of the car, taking a shovel full every foot from side to side. This will give a sample of from 150 to 200 pounds, or possibly more. Spread the coal on a tight floor, crush all lumps to the size of an egg and mix thoroughly, quarter down to about 25 pounds, crush to marble size, and again quarter down to about 10 pounds. This sample should then be brought down to ¼ inch size and quartered to 2½ pounds, placed in a fruit jar, sealed up tight and taken to the laboratory. If the sample is damp or contains much moisture, a determination of moisture should be made here in this sample without further grinding, as directed under "Proximate Analysis." The rest of the sample may be then ground

finer, quartered, again ground, etc., until finally 100 grams is obtained ground fine enough to pass a 100-mesh sieve."

A description of the Parr calorimeter is given (this Journal, **22**, 646, and **24**, 167).

This is the only method described for the practical determination of the heat of combustion of coal. S. P. SADTLER.

**Notes on Tests for Wood Paving Block.** BY F. A. KUMMER, C. E. *Chem. Eng.*, November, 1904.—Specifications for wood paving blocks for the Borough of Brooklyn contain the following provisions:

"1. The wearing surface shall be composed of long-leaf, all heart, yellow pine blocks, treated as hereinafter described. All blocks shall be of sound timber, free from bark, sapwood, loose or rotten knots, or other defects which shall be detrimental to the life of the block or interfere with its laying. No second-growth timber will be allowed.

"2. The blocks are to be treated throughout with an antiseptic and water-proof mixture, at least 50 per cent. of which shall be dead oil of coal tar, commonly known as creosote oil. The remainder to be resin or some other similar and suitable water-proof material. All portions of each individual block shall be thoroughly treated with the mixture, and after treatment the specific gravity of the blocks shall be greater than that of water.

"3. After treatment the blocks shall show such water-proof qualities that, after being dried in an oven at a temperature of 100° for a period of twenty-four hours, weighed, and then immersed in clear water for a period of twenty-four hours and weighed, the gain in weight shall not be greater than 3 per cent."

No particular composition of creosote is required.

The absorption of water is prevented by incorporating resin or some similar substance with the creosote, which would otherwise cause an absorption of 8 to 17 per cent. of water. Rosin is also supposed to harden the fibers of the wood. Results, showing relative wearing qualities when tested, are as follows:

Six blocks of each kind were tested, the size in each case being 3x3½x8 inches. Tests were made upon untreated Georgia pine blocks, blocks treated with creosote oil and blocks treated by the creoresinate process. The rattler used was a 36-inch foundry rattler, 4 feet long, and 100 pounds of iron castings were placed inside along with six blocks. The rattler was revolved at about fifteen revolutions per minute for two hours in each instance. Results were as follows:

| | Per cent. |
|---|---|
| Untreated blocks, loss | 4.8 |
| Creosoted " " | 3.1 |
| Creoresinate " " | 2.5 |

S. P. SADTLER.

**The American Sulphur Industry.** *Eng. Min. J.*, October 13, 1904.—There are only three sources of sulphur in the United States: Louisiana, Nevada and Utah. The Louisiana deposit is 230 miles west of New Orleans, 12 miles from Lake Charles and 16 miles from Sabine Pass. There is so much water in the deposit that it cannot be mined, and is worked by the process of Frasch. A 10-inch hole is drilled to the bottom of the deposit, this is lined with a 10-inch iron pipe, inside this is placed a 6-inch pipe, inside this a 3-inch and inside the latter a 1-inch. Water at a temperature of 330° F. is forced by steam boiler pressure to the bottom of the well through the spaces between the 3 and 6, and 6 and 10-inch pipes. This melts the sulphur around the pipe and the melted sulphur is pumped up inside the 3-inch pipe by the air-lift principle, by air pumps, down the 1-inch pipe. The plant consists of 36 boilers of 150 horse-power each, using 1,200 barrels of petroleum daily for fuel, and operating two wells at once, producing daily 500 to 700 tons of sulphur. The latter comes up melted, is allowed to set in large shallow tanks, and from these broken up and shipped directly to Atlantic ports, where it commands $21 to $22 per ton, and is already displacing Sicilian sulphur. J. W. RICHARDS.

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## AGRICULTURAL CHEMISTRY.

**How Food Preservatives Affect the Public Health.** BY R. G. ECCLES. *Am. J. Pharm.*, 76, 506–511 (1904).—The writer states that the word ferment is used by some authorities charged with the enforcement of the food laws in reference both to the enzymes, by which digestion takes place, and to yeasts and bacteria. He feels that the use of the word is entirely distinct and unlike meanings leads to incorrect conclusions. Admitting that some of the chemical preservatives employed may be harmful, it is claimed that much more harm results by the consumption of foods in incipient decay, owing to the fact that preservatives have not been used. It is claimed that the census report of 1900 showed a higher death-rate from diseases of the digestive system in states where food preservatives were prohibited than in states permitting their use. W. D. BIGELOW.

**Report of the Analyst of the Massachusetts State Board of Health.** BY A. E. LEACH. *Ann. Rep.*, 1903.—A detailed report is submitted, giving the results of the analytical work of the laboratory during the year.

*Milk.*—By means of inspectors the State Board of Health of Massachusetts secures samples of milk from the various cities of the state and subjects them to analysis. During the year 4,008 samples of milk were examined, of which 35.1 per cent. were found to be below standard. The report includes methods

for the detection of watered milk (this Journal, **26**, 1195 (1904)).

The usual work of the laboratory with foods other than milk was done, 3,075 samples being examined with the following results:

| Substance. | Genuine. | Adulterated. | Total. | Per cent. of adulteration. |
|---|---|---|---|---|
| Allspice | 175 | 9 | 184 | 4.8 |
| Butter | 125 | 17 | 142 | 11.9 |
| Canned goods | 4 | 2 | 6 | 33.3 |
| Cassia | 221 | 6 | 227 | 2.6 |
| Cayenne | 60 | 1 | 61 | 1.6 |
| Cheese | 36 | 26 | 62 | 41.9 |
| Chocolate and cocoa | 22 | 20 | 42 | 47.5 |
| Cloves | 187 | 21 | 208 | 10.1 |
| Coffee | 100 | 6 | 106 | 5.7 |
| Condensed milk | 65 | 11 | 76 | 14.5 |
| Confectionery | 24 | ... | 24 | 0.0 |
| Cream of tartar | 312 | 5 | 317 | 1.6 |
| FLAVORING EXTRACTS: | | | | |
| Jamaica ginger | 4 | 1 | 5 | 20.0 |
| Lemon | 8 | 19 | 27 | 70.4 |
| Vanilla | 13 | 12 | 25 | 48.0 |
| Ginger | 235 | 9 | 244 | 3.7 |
| Honey | 35 | 24 | 59 | 40.7 |
| Lard | 21 | 30 | 51 | 58.8 |
| Mace | 13 | 18 | 31 | 58.1 |
| Maple sugar | 9 | 4 | 13 | 30.8 |
| Maple syrup | 43 | 14 | 57 | 24.5 |
| Miscellaneous | 112 | 118 | 230 | 51.5 |
| Molasses | 103 | 4 | 107 | 3.8 |
| Mustard | 184 | 66 | 250 | 26.4 |
| Nutmeg | 12 | ... | 12 | 0.0 |
| Pepper | 333 | 43 | 376 | 11.4 |
| Syrups | 6 | ... | 6 | 0.0 |
| Tea | 28 | ... | 28 | 0.0 |
| Vinegar | 46 | 53 | 99 | 53.5 |
| Total | 2536 | 539 | 3075 | 17.1 |

The report includes the methods used in the examination of foods as far as any variation was made in the methods previously published. Several of these methods are of considerable value and have already appeared in the Journal.

*Drugs.*—One thousand one hundred and thirty-three samples of drugs were examined during the year, of which 471 were found to be adulterated. Special attention is called to the frequency with which arsenic is found in glycerol. This is found to have decreased from 68 per cent. of the samples in 1900 to about 5 per cent. in 1903. W. D. BIGELOW.

**Chemistry in Customs Administration.** BY R. W. MOORE. *J. Soc. Chem. Ind.*, **23**, 1017–1019 (1904).—The writer describes the nature and purpose of chemical work in connection with the Custom House and to a certain extent the manner of conducting it. Illustrations are given of the class of questions likely to be

involved. During the year 1903, 38,751 samples of raw sugar were polarized, and 7,513 samples were tested chemically. A rough classification is given of samples examined during 1903.

W. D. BIGELOW.

**Food Preservatives.** BY HENRY LEFFMANN. *Am. J. Pharm.*, 76, 503–505 (1904).—Exception is taken to the attitude of some state authorities forbidding the use of all food preservatives other than salt, vinegar, wood-smoke, etc. The author suggests that a substance cannot be considered injurious to health independently of the amount of the substance to be consumed; otherwise he suggests that the sale of food containing vanillin, caffeine, citric acid and many other ingredients must be forbidden. He states that some of the preservatives always permitted (vinegar and creosote) are highly corrosive in a concentrated state.

W. D. BIGELOW.

**The Influence of Boric Acid and Borax on Digestion and Health.** BY H. W. WILEY with the collaboration of W. D. BIGELOW. *U. S. Dept. Agr. Bull.*, 84, Part I.—The bulletin consists of 477 pages and gives in detail the results of the first year's work in the investigation being made by the Bureau of Chemistry of the influence of food preservatives and artificial colors on digestion and health. The subjects treated of are: The objects of the investigation; the plan of the investigation; the organization of the work (giving the exact manner in which the experiment was conducted, the hours of meals, bill of fare and the methods in which observations were made and daily collected); medical supervision; the methods of analysis; special difficulties connected with the work, and the results.

Five experiments are included in this work, six men being subjected to each experiment. The time of the administration of the preservative varied from thirteen to fifty days. The work included a study of metabolism, the clinical examination of the urine and medical examination of the men. The results are given in 95 tables, varying from 1 to 5 pages in length.

It is concluded that when boric acid or its equivalent in borax is taken into the food in quantities not exceeding 0.5 gram per day no notable effects are immediately produced. In case of any continued exhibition of small doses, or of large doses extending over a shorter period, manifest physiological symptoms often result. Four grams per day is regarded as the limit beyond which boric acid cannot be administered to the normal man without making him ill and unfit for duty. In some cases 3 grams per day of boric acid produces the same result, though the majority were able to consume that amount for a number of days. In all cases injurious effects of the dose were felt. It was found that 2 grams per day of boric acid could be administered for a con-

siderably longer time without producing illness, and 1 gram was given for ten days without marked symptoms.

It is held to be demonstrated that boric acid and borax, when continuously administered in small doses for a long period, or when given in large doses for a short period, create disturbances of appetite, of digestion and of health. It is suggested, as a logical conclusion that the use of boric acid and borax should be restricted to those foods where the necessity therefore is clearly manifest, and where it is demonstrable that other methods of food preservation are not applicable and that without the use of such a preservative the deleterious effects produced by the foods themselves, by reason of decomposition, would be far greater than could possibly come from the use of the preservative in minimum quantities. It is further suggested that as a matter of public information, and especially for the protection of the young, the debilitated and the sick, that, when it is employed, each article of food should be plainly labeled and branded in regard to the character and quantity of the preservative employed.

W. D. BIGELOW.

**Manufacture of California Olive Oil.** BY G. W. SHAW. *Cal. Agr. Expt. Sta. Bull. No.* 158.—The bulletin consists of a technical description of the machinery and processes employed in the manufacture of olive oil, both on a large and on a small scale.

W. D. BIGELOW.

**Contribution of the Study of Fermentation.** BY E. H. TWIGHT AND CHARLES S. ASH. *Cal. Agr. Expt. Sta. Bull. No.* 159.—The authors have special opportunities for this study aside from the ordinary laboratory facilities as they were able to make observations on 360 fermentations in tanks of 5,000 gallons capacity each. They find that cooling of the must in such a manner as to maintain the temperature below 85° F. lowers the percentage of volatile acids, lowers the percentage of albuminoids (making the wine easier to clear), lowers the percentage of sugar and increases the percentage of alcohol.

They also experimented with pure cultures and found that with their use the fermentation started more promptly, and that in the finished product the percentage of volatile acids and sugar were lower and the percentage of alcohol higher than in wines fermented with their natural yeasts. They also find that the correction of the acidity of must low in acids greatly assists in the fermentation of dry wines. In the case of many of these observations the authors call attention to the fact that they have been suggested in other wine regions and point out their exact influence in the manufacture of California wine.

W. D. BIGELOW.

**Mannite as Reserve Food in Flowering Plants.** BY F. H. STORER. *Bull. Bussy Inst.*, 3, Part 4 (1904).—The author sug-

gests that mannite be detected by treating its aqueous solution with a small quantity of ferrous sulphate and 10 cc. of commercial hydrogen dioxide. It is then left at rest for half an hour, the solution made faintly alkaline with sodium carbonate and filtered. The filtrate, acidulated with acetic acid, is evaporated to soft dryness, the residue taken up with 1 cc. of water and the solution filtered. The addition to the filtrate of a few drops of phenylhydrazine acetate causes the formation of the hydrazone in characteristic balls with blunt spines in about five minutes. The product was recrystallized into somewhat more characteristic form from a mixture of 3 parts of 95 per cent. alcohol and 1 part of water.

Mannite was not detected in a variety of grasses that were examined. It was also found to be absent in the fresh leaves, flower stalks and blossoms of the red clover, in onions, cabbage, carrots, parsnips, celery leaves, carrot leaves, cherries, prunes, raisins, bananas and apples. Mannite was found in turnips and dried figs. W. D. BIGELOW.

**The Occurrence of Mannan in Trees, Roots and Fruit.** BY F. H. STORER. *Bull. Bussy Inst.*, 3, Part 4, (1904).—The amount of mannan found in pine wood of different age and cut at different seasons is given as well as the amount found in spruce and fir wood. In addition to the results previously published the author reports the presence of mannan in yellow turnip, cabbage, beets, parsnips, celery stalks, prunes, and figs. No mannan was detected in June grass or oat hay. W. D. BIGELOW.

**The Popping of Indian Corn.** BY F. H. STORER. *Bull. Bussy Inst.*, 3, Part 4 (1904).—The main results of Brewer, Wilbert and Kraemer are repeated and confirmed. It is found that no reducing sugar, dextrin or soluble starch is produced by the action of popping. W. D. BIGELOW.

**Observations on a Malt-glucose Known as "Midzu-ame."** BY F. H. STORER. *Bull. Bussy Inst.*, 3, Part 4 (1904).—The article (a glucose made by the action of diastase on millet or rice) gives the results of chemical analysis of midzu-ame, which agrees in the main with previous analyses that had been published by other analysts. The article is of interest because of a detailed description of the method of manufacture of midzu-ame and references to the use in early times of sweetening materials that may have been a somewhat cruder form of the same article.

W. D. BIGELOW.

**Influence of Formaldehyde on the Digestive Enzymes.** BY T. M. PRICE. *20th Ann. Rep. Bur. Animal Ind., Dept. Agr.*, 1903, p. 114.—Experiments were conducted *in vitro*. Varying amounts of formaldehyde were added to milk containing rennet,

pepsin or pancreatine; to fat containing steapsine; to starch-containing ptyalin or amylopsin.

Results showed that formaldehyde might be added to food, *in vitro*, in proportion of 1 : 2,500 without affecting the action of the enzymes. In proportion 1 to 20,000 in milk, which is sufficient to preserve the milk forty-eight hours, formaldehyde does not interfere with the activity of the galactase. This amount of formaldehyde is sufficient to prevent the development of the more common bacteria found in milk. Formaldehyde, 1 : 10,000, in milk is enough to prevent the development of these bacteria, preserve the milk and yet shows no deleterious effect on its digestibility.
J. A. LECLERC.

**Analysis of Emmer and Spelt.** BY A. J. CHARRON. *Cent. Expt. Farm. Ottawa, Bull.*, 45.—This bulletin gives the composition of the whole grain, kernels and hulls of emmer and spelt, respectively. Two varities of each are here analyzed. Results show that the hulls and kernels of spelt have a higher feeding value than the respective parts of emmer, but when the whole grain is considered, emmer is superior to spelt, owing to the very large amount of hulls which spelt has.
J. A. LECLERC.

**West Indian Fodder Plants.** *West Indian Bull.*, 5, *No.* 2, (1904).—Contains ordinary chemical analysis of the various fodder plants indigenous to different regions. Some of these fodders are exceedingly rich in nitrogenous material and very nutritious.
J. A. LECLERC.

**Protein Content of Wheat Kernel.** BY J. N. HARPER AND A. M. PETER. *Ky. Agr. Expt. Sta. Bull.*, 113.—Comparison is made between the flinty and the starchy kernels. The former are always richer in protein, and in some varieties these have as much as 5.9 per cent. more protein than do the starchy kernels.

Larger kernels are richer in protein than are the smaller ones. The grains near the center of the head are more nitrogenous than those near the base, or the tip.

Early wheats are also richer in protein than the later varieties.
J. A. LECLERC.

**Concentrated Feeding-stuffs.** BY J. P. STREET, W. P. ALLEN, AND V. J. CARBERRY. *N. J. Agr. Expt. Sta. Bull.*, 175.—The law in New Jersey requires a guarantee of the fat and protein in all feeding-stuffs. In this bulletin is found complete feed analyses of each of the brands on the market, besides the amount of their manurial constituents, nitrogen, phosphoric acid and potash.
J. A. LECLERC.

**Soy Beans.** BY C. D. WOODS AND J. M. BARTLETT. *Me. Agr. Expt. Sta. Bull.*, 106.—The bulletin treats of the chemical composition of soy beans and their digestibility when fed to sheep.
J. A. LECLERC.

**Range Forages.** *14th Ann. Rept., Arizona Agr. Expt. Sta.*—Analyses are given of ten grasses, salt bushes or shrubby plants, showing their value for grazing animals. J. A. LeClerc.

**Character of Milk During the Period of Heat.** By C. F. Doane. *Md. Agr. Expt. Sta. Bull.*, 95.—Analysis of cow's milk produced during the period of heat show normal composition, no perceptible change from the composition immediately before or immediately after that period being apparent.

J. A. LeClerc.

**Increase of Fat in Milk by Means of Liberal Feeding.** By H. H. Wing and J. A. Foord. *Cornell Agr. Expt. Sta. Bull.*, 222.—Seven cows were on experiment. There were two periods of scant and two periods of liberal ration. Results of analyses showed that the milk produced while the animals were on a liberal ration contained 0.25 per cent. more fat than when they were on a scant ration. Each cow produced richer milk and a greater quantity during liberal feeding. J. A. LeClerc.

**The Effect of Preservatives on Health and Digestion.** By H. W. Wiley. *J. Frank. Inst.*, January, 1905, p. 23.—A lecture delivered before the Franklin Institute, Philadelphia, November 4, 1904. The author mentions briefly the desirability of preserving food, the different methods of preservation employed and the differences of opinion among physicians, chemists and physiologists regarding the use of chemical preservatives and their effect upon health. He gives a brief account of the experiments of the Department of Agriculture with borax and boric acid, and the results obtained (noted in this Journal, **26**, R, 392). The rôle of mineral substances in nutrition is considered, and the possibility of serious effects of excessive quantities upon the organs of excretion, especially the kidneys. The remainder of the lecture is devoted to a discussion of the question "Are minimal quantities of preservatives permissible?" R. D. Milner.

**Chemical Composition of Some Tropical Fruits and Their Products.** By Ed. MacKay Chace, L. M. Tolman, and L. S. Munson. *U. S. Dept. Agr., Bur. Chem., Bull. No.* 87, p. 38.—This bulletin gives the results of a study of Cuban fruits and of an investigation of the composition of fresh and canned pineapples.

The study of Cuban fruits was made during the season of 1902, at which time Mr. Chace was stationed in Havana, where he was able to procure the fresh fruit as it was placed upon the market, as well as a large number of preserves of various descriptions that are manufactured on the island. The fruits examined were the orange, grape-fruit and lime of the citrus fruits, guava, banana, mango; three species of anona, *viz.*, sour-sop, sweet-sop and cust-

ard apple, sapota, mamey colorado, mamey de Santo Domingo, hicaco, cashew and star apple.

*Citrus Fruit.*—The grape-fruit and lime grow in a semi-cultivated or wild state on the Island, and the oranges are inferior in variety as well as quality to those grown in this country. The possibilities for development of the citrus fruit industry on the Island seem very favorable. The "China" orange, which is largely grown, resembles the American varieties in composition, while the thick-skinned orange shows a low acidity and high content of insoluble solids. Several samples of orange paste and marmalade were examined, all of which showed low content of acids and high content of sugars—a characteristic of all Cuban fruit preserves. Comparison of the composition of the grape-fruit with that of the California product shows the California fruit to have about four times the amount of acid contained in the Cuban fruit and only slightly more sugar, while the Cuban limes very closely resemble the California lemons in content of acids and sugar.

*Tamarind.*—This fruit, which is from a leguminous tree, is of characteristic composition; the edible portion contained over 50 per cent. of solids, of which sugars comprised over 30 per cent. and acids (calculated as $H_2SO_4$) over 6 per cent. The fruit is used in making summer beverages and flavoring soda-water syrups. Samples of preserves of this fruit were examined which consisted of mixtures of granulated sugar and the fruit pulp.

*Guava.*—The most commonly used varieties of guava are the pear-shaped and the white, although a third variety having a colored pulp is used in making low-grade preserves. The composition of the guava is peculiar in that more than 50 per cent. of the total solids are insoluble. The percentage of total sugar in this fruit is rather low. While not eaten raw, the guava is extensively used in the manufacture of high-grade jellies and pastes; several of these products were examined. In chemical composition they closely resemble products of similar nature put up in this country.

*Banana.*—A number of varieties of the banana are grown in Cuba, and this fruit is the principal food of the lower classes. It has a high percentage of solid material, a large part of which in the well-ripened fruit is sugar. The percentage of insoluble solids depends upon the state of ripeness of the fruit, as during the ripening of the banana there is a gradual change of starch into sucrose and invert sugar and sucrose into invert sugar. Of the several varieties grown on the island only the Johnson will stand shipment well.

*Mango.*—A number of varieties of mango are grown in Cuba and some of these are highly cultivated. The fruit is very popular with the native Cuban and is largely consumed in the raw state, although mango jams and jellies were obtained upon the market.

The Filipino variety is by far the best mango grown on the island; it also stands shipment well. Results of analysis of the different varieties show the Filipino variety to be much the largest and to contain the highest percentages of edible matter and of total sugars, of the samples examined.

*Anona.*—The sour-sop is extensively used in making summer beverages, flavoring syrups and water ices, and for preserving; the sweet-sop is also used for flavoring syrups and ices and is eaten in the fresh state, while the custard apple is used largely in the fresh state. The sour-sop varies in weight from 100 grams to 1 kilo and sells for a high price during the season: the sweet-sop is of much smaller size. In composition the sweet-sop contains a higher percentage of sugar and lower percentage of acid than the sour-sop.

*Sapota, Mamey Colorado, Mamey de Santo Domingo, Hicaco, Cashew* and *Star Apple.*—With the exception of the star apple, which finds but little use, and the mamey de Santo Domingo, which is also eaten in a fresh state, these fruits are used largely for preserving. The sapota averages about two ounces in weight, stands shipment well, and retails at ten to fifty cents per dozen. Samples of preserved pulp of this fruit closely approaches in composition that of the fresh fruit. The mamey Colorado averages about 700 grams in weight and during the season sells for five to fifteen cents. The mamey de Santo Domingo, the largest of which weigh 700 grams, is highly esteemed for preserving and retails for about ten cents each. The hicaco is a small fruit weighing only about eight grams, and has a seed weighing about half as much as the fruit. The cashew is a small fruit having a small kidney-shaped seed on the outside of the fruit at its lower extremity. The seed is said to be poisonous until roasted, when it is eaten with great relish, the meat resembling that of roasted chestnut.

*Analysis of Ash.*—The citrus fruits contain large amounts of lime and iron; the tamarind shows a high content of silica; the bananas are low in lime and magnesia and high in chlorine. A full report is given of a study relating to fresh and canned pineapples. (This Journal (1903), **25**, 272.) L. S. Munson.

**Pineapple Culture II, Varieties.** By H. Harold Hume and H. K. Miller. *Fla. Agr. Expt. Sta. Bull.*, 70, pp. 37–63.—Analysis of twelve different varieties of pineapples are given, and in the discussion of results it is stated that disregarding flavor, the amount of insoluble solids, the percentage of acid present, and the kind and quantity of sugar, determine the quality of a pineapple. In the twelve varieties acids vary from 0.59 to 2.11 per cent. (expressed as $H_2SO_4$), cane-sugar varieties from 2.30 to 9.41 per cent., and reducing sugars from 1.81 to 4.05 per cent. It is noted that those varieties having low acidity are usually high in sugars and

*vice versa.* The determinations of acids and sugars in various parts of the pineapple show that sugars decrease and acids increase with ascent from the base to the crown, and in passing from the core to the circumference. L. S. MUNSON.

**Sugar Beets.** BY F. W. TRAPHAGEN. *Montana Agr. Expt. Sta. Bull.*, **52**, pp. 56.—The author discusses the factors necessary for the successful operation of a sugar factory, and the culture of the beet, and reports results obtained throughout the State and at the Station upon beets grown during 1903. Twenty-seven samples of beets grown in nine different counties showed an average sugar content in the beet of 11.87 per cent. and an average yield per acre of 12.5 tons. Tests of six varieties at the station showed a variation of 13.3 per cent. to 16.2 per cent. of sugar in the beet. On the whole, results of experiments in 1903 are considered unsatisfactory as compared with results obtained in previous years.
L. S. MUNSON.

**Magnesium as a Manure.** BY H. J. WHEELER AND B. L. HARTWELL. *Rhode Island Agr. Expt. Sta. 17th Ann. Rep.*—The possible deficiency of the soils of the Station in magnesia was suggested by the ash analysis of red clover and of common sorrel grown on limed and unlimed soil. While the other constituents of the ash were no greater and in most cases were lower, in the plants grown on the limed plots, magnesia was increased about 2.9 times in the clover and 2.7 times in the sorrel by liming. Barley and oats grown in pots on the soil to which fertilizer and calcium carbonate had been added gave a slight decrease where magnesium sulphate was used. Golden millet gave slightly the best yield with magnesium sulphate. On soil from Kingston plain, however, quite marked increases of barley and of oats were obtained under the same conditions from the use of magnesium sulphate, while magnesium chloride gave increased yields of barley and of rye on unlimed soil, but a slight decrease of oats when potassium magnesium carbonate had been added to all pots. It was observed that both the magnesium sulphate and magnesium chloride used in these experiments gave an alkaline reaction to phenolphthalein in aqueous solution.

The work of Knop, Loew and of May on the effect of magnesium salts is discussed at some length and it is pointed out that these investigators neglected certain factors bearing upon the question of magnesium poisoning. These factors are the direct injurious action on the plant of a deficiency of lime, of the natural acidity of the soil, of the increase in acidity due to the use of kainite, or other neutral salts, and to excess of magnesium as bicarbonate in some of the soils or solutions worked with. In an analysis of the data of May it is argued that as the total alkalinity of magnesium bicarbonate solutions (to litmus or methyl orange) is considerable, this alkalinity may have been of itself sufficient to

injure plants irrespective of the base. Calcium bicarbonate being much less soluble produces no such effect. As the addition of calcium carbonate to soils containing magnesium bicarbonate may not reduce the alkalinity, such addition does not reduce the injury due to magnesium bicarbonate. On the other hand, calcium sulphate reduces alkalinity by forming calcium carbonate and magnesium sulphate and injury to plants is not so great, as was shown in May's experiments.

A number of experiments are cited to show that large yields of some plants are obtained when easily soluble magnesia salts are in excess of lime salts, thus throwing doubt on the validity of Loew's conclusion that maximum yields are obtained with a certain ratio between these two nutrients (lime and magnesia). It is urged that full consideration should be given to these several factors before conclusions either as to magnesia poisoning or as to the proper ratio of lime to magnesia can be formulated.

The article is preceded by a brief review of the literature bearing on the subject. F. P. VEITCH.

**Soil Bacteria and Nitrogen Assimilation.** BY F. D. CHESTER. *Del. Agr. Expt. Sta. Bull.*, 66.—The author considers that the question "Are nitrogen-fixing bacteria commonly present in soils?" can undoubtedly be answered in the affirmative. Certain bacteria which are at least feebly nitrogen-fixing such as, *Bellenbachiensis* and *B. megatherium*, are predominating forms in all soils examined by the author. As the former is the active bacteria of alinit, the failure of this material to be of general practical value is explained. The author experimented with pure cultures of various bacteria determining the nitrogen fixed during varying periods of growth, checking the results by blanks on the reagents and culture solutions. Nitrogen was determined by oxidizing with sulphuric acid and potassium sulphate, distilling and nesslerizing the distillate. All the organisms show a slight but undoubted power of assimilating free nitrogen, *B. alcaligenes*, *Ps. flurescens non-liquefaciens* and alfalfa tubercle bacteria were particularly active, the gain of nitrogen being as high as 43 per cent. The nitrogen fixers growing in symbosis show increased power of assimilating nitrogen, but the amount is less than the sum of their individual capacities. Deep plowing and thorough tillage are the best means of stimulating bacterial activity. W. D. BIGELOW.

**Investigations in Soil Fertility.** BY MILTON WHITNEY AND F. K. CAMERON. *Bur. of Soils, U. S. Dept. Agr. Bull.*, 23.—Numerous experiments dealing with the movement of water in soils containing a so-called optimum amount of water and those approaching a condition of drouth did not show any relation between this movement and the fertility of the soils. The water movement was measured by the loss by evaporation when the soils were exposed to sun and air or placed in an oven.

"Certain experiments in which small glass tubes and ordinary tumblers were used, when placed upon a hot plate or upon a stone surface in the sun, showed the peculiar phenomenon of an excessive loss of water from below—that is to say, a change of color was frequently noticed on the bottom or on the side exposed to the sun, which indicated a more rapid drying in that part, than in other parts of the soil mass. It was suspected, therefore, that evaporation which had been used as the measure of the transporting power of a soil, did not take place at the surface alone, but throughout the soil to a considerable depth, and that the presumption, upon which the foregoing experiments were undertaken, *i. e.*, that the water moved through capillary or similar agencies to or near the surface before evaporation, was untenable."

In the study of the ability of seeds to obtain moisture from the soil, in germination, "another interesting phenomenon observed is, that small seeds, like clover and wheat, germinate if left on the surface of a moist soil." This is in perfect accord with the practice, common with farmers, of sowing clover seed in the spring, upon fall wheat.

Wheat seedlings grown in the water extracts of different soils—some good, some poor—showed at once a greater transpiration and, in a few days, a greater root development and a healthier appearance, in the extracts from the good than in those from the poor soils, thus indicating that "the availability of the moisture and its dissolved salts, is due to something other than the texture or physical condition of the soil."

Transpiration was increased by sterilizing the soil extract and by removing the soluble organic matter with charcoal or with potassium permanganate. Soil treated with fuming nitric acid and washed, gave a greater transpiration than did the untreated soil. A poor sandy loam, treated with the extract of sumac leaves, or pyrogallol, to increase the organic matter, gave a higher transpiration than the untreated soil. J. H. PETTIT.

**The Centrifugal Method of Mechanical Soil Analysis.** BY LYMAN J. BRIGGS, F. O. MARTIN, AND J. R. PEARCE. *Bur. of Soils, U. S. Dept. Agr., Bull.*, 24.—All apparatus necessary for a mechanical analysis of a soil is described and the manipulation, with precautions, is given in considerable detail. In connection with this, data are given to show the effect of oven-drying and of shaking on the mechanical composition; the result of the use of ammonia in mechanical analysis, and the accuracy of the centrifugal method.

Descriptions are given of Hilgard's Elutriator Method, Osborne's Beaker Method, King's Aspirator Method and Yoder's Centrifugal Elutriator Method for the Mechanical Analysis of Soils. The four arbitrary systems most extensively used in mechanical analysis, for the classifying of the soil particles into different

grades, and the limits of these grades, are given and compared. The determination of organic matter in soil is discussed and the chromic acid combustion method is given in detail.

J. H. PETTIT.

## PATENTS.

JULY 12, 1904.

764,971. Anton Aagaard, Everett, Washington. **Waterproof leather dressing.** Dogfish oil 14, pine root tar 5 parts, and turpentine as a diluent.

764,986. Francis J. Bulask, Toledo, Ohio. **Artificial fuel.** Anthracite culm 2000, sodium chloride 10, chalk 5, fluor spar 4, saltpeter $^1/_2$, copper acetate $^1/_2$, and a binder of silica 100, and alkaline sulphates 10-20 parts, aluminum phosphate and lead carbonate, phosphate and sulphate in small quantities.

765,000. Gustav Gin, Paris, France. **Copper sulphate.** Sulphur ores are roasted to form sulphates of iron and copper, lixiviated, and the solution digested with previously roasted ore to complete the oxidation.

765,001. As above for **vanadium and alloys.** An anode of carbon and vanadium oxide is electrolyzed in a fused bath of calcium fluoride and a fluoride of the metal whose alloy with vanadium is desired, and said metal in a metallic state is brought near the anode.

765,079-80. Paul Julius and Carl Winter, Ludwigshafen-on-Rhine, Germany. Assignors to Badische Anilin und Soda Fabrik, same place. The first, **red azo dye,** from diazotized *o*-chlor-*p*-toluidine with 2-naphthol 3-6-disulpho acid whose sodium salt is brilliant red, hardly soluble in cold water, easily soluble in hot water whose barium lake on reduction with zinc dust in solutions containing ammonia gives *o*-chlor-*p*-toluidine and aminonaphthol disulpho acid.

In the second the second component is $\beta$-naphthol, giving a yellower color, and on reduction amino naphthol in place of its acid.

765,148. Philip T. Peace, Philadelphia, Pa. Assignor to Philadelphia Extracting Co., N. J. **Removing alcohol from empty casks.** First run in hot air and then pass air and alcohol vapor through a condenser and condense the alcohol, the temperature of the first reagent being controlled by steam.

JULY 19, 1904.

765,164. Jurgen Callsen, Elberfeld, Germany. Assignor to Elberfeld Co., New York, N. Y. *m*-**Tolyl-semicarbazide** having the formula $C_6H_4\left\langle\begin{array}{ll}CH_3 & (1)\\ NH{-}NH{-}CO{-}NH_2 & (3)\end{array}\right.$ being white lustrous

crystals, melting at 183° to 184° C., sparingly soluble in cold water, soluble in hot water and alcohol, insoluble in ether and reducing silver nitrate in aqueous solution.

765,201. Robert E. Schmidt, Elberfeld, and Paul Tust, Vohwinkel, Germany. Assignors to Elberfeld Co., New York, N. Y. **Anthrarufin.** A water solution of 1-5-anthraquinone disulphonic acid is heated with an alkaline earth, and the resulting dihydroxy-anthraquinone separated. Calcium oxide preferred.

765,238. Isaac H. Goodman, Philadelphia, Pa. **Fiber strip.** Ramie and wool fibers are united together by glue to form flexible material for trimmings for dress.

765,275. Moses M. Fields, Lockney, Texas. Assignor two-thirds to J. W. Edwards and W. M. Winn, of Texas. Making **pictures.** An albumen print is fastened to a transparent base by hot gelatin, and made transparent by a solution of neats foot oil in wood alcohol, the back of the print painted to indicate eyes, clothing, flowers and scenery, a transparent backing is then applied and painted on the back to represent flesh, hair and background.

765,291. Wincenty Matzka, Vechelde, Germany. **Sulphur baths.** Liver of sulphur 40, is dissolved in alcohol 100, and steam distilled pine needle oil 7 and turpentine 18 parts added. The mixture is added to a bath.

765,358. Jules Dansette, Paris, France. **Ceramic articles.** A reinforce of wire gauze is embedded in a fusible paste of kaolin, silica, boric acid and alkaline salts and dried at 40° C., then baked at 900° C., for four or five minutes till fusion begins, then coating the article with a similar but less fusible paste, drying and baking at 1000° C., then decorating with enamels of various silicates fusing below 1000° C., and having the same coefficient of expansion as the body of the plate, baking for five minutes and cooling.

765,417. Herbert H. Dow, Midland, Mich. **Bromides and bromates.** Bromine and air free from carbon dioxide are brought in contact with potassium bicarbonate, which produces bromides and bromates.

765,418. Herbert H. Dow, Midland, Mich. Assignor to Dow Chemical Co., same place. **Decomposing alkaline carbonates.** Fresh air containing bromine is brought in contact with a carbonate and then discharged from the system of apparatus carrying off the carbon dioxide.

765,444. Adelaide M. Thomas, Dallas, Texas. **Artificial fuel.** Powdered lignite 75, asphalt 8, glucose 10, and steatite 6¾, sodium bicarbonate ¼ per cent.

765,459. Phillippe Chuit, Geneva, Switzerland, and Fritz Bachofen, New York, N. Y. Assignors to Chuit, Naef and Co.,

Geneva, Switzerland. **Cylic ketones.** Hydrolyzed pseudoionone is treated with concentrated acid, the products washed out and distilled, giving alpha products distilling at 134° to 143° C., and $\beta$ products distilling at 132 to 150 under 11 to 14 mm. pressure.

765,520. Auguste L. Stinville, Paris, France. **Sulphuric acid.** Acid at a temperature 15° to 20° C., below that of the gases, and 3° to 5° Beaumé below the acid on the sides of the chambers is caused to circulate through dishes in the chambers.

765,540. Franz Brogniez, Detroit, Mich. Assignor to Vacuum Fermentative Co., Rochester, N. Y. **Automatic air supply.** A fermenting tank, a suction pipe leading into the bottom of the tank, and an air regulating device having a valve attached to a flexible spring actuated diaphragm moved in one direction by suction, and in the opposite direction by a spring so as to secure a uniform air supply to the tank.

765,576. Otto J. Graul, Ludwigshafen-on-Rhine. Assignor to Badische Aniline und Soda Fabrik, same place. **$\omega$-Cyanmethyl anthranilic acid.** Anthranilic acid and formaldehyde are condensed and the product treated with hydrogen cyanide.

765,577. Harry E. Hall, Mattoon, Ill. **Treating pictures.** Albumen prints are mounted on glass and the following composition applied to them so they will be transparent and can be colored from the back. Gelatine 2, water 24, carbolic acid 0.140, leaf green color paste 0.110, mixed alcohol and oil cassia 0.56, castor oil and gasoline 16 each, oil sassafras 2, alkanet root solution 1 part by weight.

765,581. Paul Julius and Siegfried Haeckel. **A blue black azo dye.** 2-4-Dichlornaphtylamine sulpho acid is diazotized and converted into hydroxy-chlor-diazonaphthalene sulpho acid which is then combined with $\beta$-naphthol, forming a blue solution with sodium carbonate, which hydrochloric acid turns red and caustic soda blue red, soluble in sulphuric acid violet blue.

765,590. Paul E. Oberreit, Ludwigshafen-on-Rhine. Assignor to Badische Anilin und Soda Fabrik, same place in Germany. **Purifying indigo.** It is heated to 200° or 270° C., to vaporize impurities, but below its subliming point.

765,597. Eugen Sapper and Friedrich Reubold, Ludwigshafen-on-Rhine, Germany. Assignors to Badische Anilin und Soda Fabrik. **Sulpho acid ester.** Cresol esters of *p*-toluene sulpho acid are acted on by manganese dioxide and sulphuric acid, to make bodies having the formula $C_6H_4\left<\begin{array}{ll}COH & (1)\\ OSC_2C_7H_7 & (2)\end{array}\right.$ soluble in ether and hot alcohol, difficultly soluble in water, melting below 100° C., which,

on saponification, yield *p*-toluene sulpho acid and *o*-hydroxybenzaldehyde.

765,637. Robert E. Schmidt, Elberfeld, and Paul Tust, Vohwinkel, Germany. Assignors to Elberfeld Co., N. Y. **Chrysazin.** 1-8-Anthraquinone disulphonic acid is heated with barium hydroxide and water to 170° to 180° C., then acidified with hydrochloric acid, and finally the 1-8-dihydroxyanthraquinone is separated.

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765,706. Carlo Lamargese, Rome, Italy. **Case hardening.** Charcoal is made from wild pine bark, pulverized with lampblack, and the articles bedded in the mixture, and the whole heated for the required time.

765,724. Herbert B. Atha, East Orange, N. J. **Recarburizing steel.** Scrap steel is placed in an open hearth furnace surrounded by a mixture of scrap steel and finely divided carbon, then raising the temperature till the carbon is absorbed by the entire charge of steel.

765,789. Samuel V. Peppel, Columbus, Ohio. **Briquetting flue dust.** Lime is added to the flue dust with some water and ammonium chloride, the mixture molded and steamed.

765,838. Wm. S. Horry, Niagara Falls, N. Y. Assignor to Union Carbide Co., same place. **Carbids.** An alternating current of more than 130 periods per second is passed through a mixture of **carbon and a calcium compound.** Electrolytic losses are thereby avoided.

765,898. Charles Lewis, Toronto, Canada. Extracting **soluble albumen** from milk. The fat is removed as by churning, the casein precipitated by alcohol, the supernatant liquid partly poured off and the rest evaporated, and the casein powdered and heated to 149° F.

765,943. Karl F. Tollner, Bremen, Germany. **Cod liver oil substitute.** Algae are dried, cut fine, roasted, powdered and extracted by a fatty oil, the extract separated and filtered.

765,996. Albrecht Schmidt and Rudolf Müller, Hoechst-on-Main, Germany. Assignors to Meister Lucius und Bruning, same place. **Brominated indigo.** Indigo is electrolyzed in aqueous solution without a diaphragm. A thin paste of indigo suspended in 40 per cent. hydrobromic acid is used for electrolyte. 2.5 Volts and 3 amperes of current may be used.

765,999. Wm. H. Simpson, Peoria, Ill. **Smokeless gunpowder.** Potassium chlorate 37, and yellow potassium prussiate 25 are mixed dry, enough water added to form a dough, a saturated solution of flowers of sulphur in ether 8 parts added, also a saturated solution of Columbian spirits containing 30 parts tannic acid, the whole mixed, granulated and dried.

766,085. Richard B. Wheatly, Barnsbury, England. **Alloy.** Copper 60, zinc 40, and a mixture of manganese, iron, tungsten, aluminum, tin and strontium making about 2 per cent. 160 parts of zinc is melted first and 8 parts strontium sulphate added, then 640 parts copper, 240 parts zinc and 8 parts of copper manganese alloy having 2 parts of the first to 1 of the second, then a similar mixture of tungsten and iron, and finally tin and aluminum.

766,131. Herbert B. Atha, East Orange, N. J. **Recarburizing scrap steel.** Finely divided carbon is suspended in salt water, oil, or molasses, the scrap steel immersed, dried and heated on an open hearth furnace till it has absorbed the carbon.

766,133. John W., Frank T., and Mark Bailey, Jersey City, N. J. Assignors to United Lead Co., same place. Treating **white lead residue.** This is composed of lead, its carbonate and oxide, and it is moistened with acetic acid and then oxidized by passing it through a sloping revolving cylinder half full of acetic acid.

766,146. Wm. M. Jewell, Winetka, and Wilford J. McGee, Oak Park, Ill. Assignors to themselves and O. H. Jewell, Chicago, Ill. **Purifying water.** Barium carbonate and sodium sulphate are added to the water which is then electrolyzed.

766,154. Wincenty Matzka, Vechelde-near-Brunswick, Germany. **Sulphur bath.** Pine needles are distilled with steam and liver of sulphur dissolved in the distillate, the solution is shaken with alcohol and the alcoholic extract added to pine needle oil for use in the baths.

AUGUST 2, 1904.

766,167. Wm. S. Bucklin, Phalanx, N. J. **Refractory shell lac.** Commercial lac is surrounded by water or by illuminating gas and heated to about 325° F., by which the volatile portions of the lac that injure food products are driven off, and the melting-point raised. Used for lining fruit cans, etc., as a varnish.

766,188. George W. Hopp, Olympia, Wash. **Fuel briquet.** Mineral oil or residuum 85, coal tar and water, 5 each, ferric sulphate 3 and calcium carbonate and rosin 1 part each.

766,212. Alexander P. Anderson, Bedford Park, N. Y. **Cereal product.** The grain is put in a closed vessel, in which the air is condensed, then the pressure is suddenly released, the grain puffs up, the starch granules being disrupted.

766,254. Albert E. Hughes, Darien, Conn. **Soap tablet.** A soap cake with a finely powdered interior and a hard shell but capable of disintegration by water.

766,289. Alfred Schwartz, New York, N. Y. Assignor to Chas. N. Lindley, same place. **Separating materials.** The powdered material is first moistened with water, and the mixture

introduced into oil, the gangue absorbing the water is made heavier, and the metalliferous portions are retained in the lighter liquid and the nonmetalliferous portions go into the heavier liquid, the bath consisting of oil over salt water.

766,398. Lydia C. Sharpless, Philadelphia, Pa. Assignor to Cyrus Chambers, Overbrook, Pa. Making **bread.** The flour is sifted lightly into the water and yeast, etc., necessary and drawn through so as to coat each particle of flour with liquid, the dough is then thoroughly pulled and set to rise, then baked.

766,400. John C. H. Stut, Oakland, Cal. Making **gas.** A body of coal is brought to incandescence by air from below passed through it, the air is shut off and oil sprayed on the hot coal, the oil gas is mixed with steam and coal gas from an auxiliary gas retort heated by the first furnace, the mixture of three gases is brought into a fixing chamber, and the operation reversed as regards the furnaces.

766,506. Valentin Lapp, Leipzig, Germany. **Coating iron vessels.** They are painted first with a solution of tannic acid, then with oil, and finally they are subjected to a blast of hot air under pressure. The process is especially adapted for pasteurizing vessels.

766,540. Otto Sohst, Hoechst-on-Main, Germany. Assignor to Meister Lucius und Bruening, same place. **Orange dye.** Mineral acids are added to glycinacridines in alcohol and the product oxidized, making brown red powders, soluble in water, difficultly soluble in alcohol, insoluble in ether, benzene and ligroin, soluble in concentrated sulphuric acid, yellow with green fluorescence, dyeing leather and tannin mordanted cotton orange to orange red.

766,554. John C. H. Stut, Oakland, Cal. Making **gas.** A layer of non-combustible porous material on the bottom of an oven is heated to incandescence and oil sprayed on it forming oil gas and a layer of carbon on the material, the oil is shut off and steam passed through to form water gas, and the two kinds of gas are mixed.

766,628. Wm. B. Kerr, Medford, Mass. Separating the fluids and solids of **fats.** 200 pounds fat are boiled in 100 pounds water twenty minutes, cooled to 120° F., one ounce papain in one quart water added, the whole boiled ten minutes, the liquids and solids allowed to separate by gravity, and the solids pressed.

766,654-5-6. Ralph Baggaley, Pittsburg, Pa., and Charles M. Allen, Lolo, Mont. Allen assignor to Baggaley. Treating **ore and matte.** The first for blowing a molten bath of low grade matte and adding an ore rich in silica to flux the iron, then adding ore low in silica and high in matte. The second for smelting sulphide ore, charging it into a converter with silicious ore, with-

drawing the melted slag and pouring it on the ore while smelting. The third for adding to a molten bath of matte small quantities of silicious ore as in the first, but heating the added ore before adding it to the bath.

766,717. John G. Mallonee, Charlotte, N. C. Assignor one-half to John Jefferson Mallonee, Crichton, Ala. Distilling **pine wood.** Three fractions are made by first obtaining crude oils by heat and steam, condensing the distillate in three parts, having a gravity respectively between 0.855 and 0.92; 0.92 and 0.96; and 0.96 and 1.00, the same being separated into the commercial products by external heat and steam applied to the bottom only of the still.

766,720. Christian W. Meinecke, Jersey City, N. J. Assignor to Meinecke and Co., New York, N. Y. **Thermometer.** It has a stem and solid flattened head extending throughout at right angles to the length of the stem, said head provided with a sharp or angular portion having its apex in line with the prism front to act as a focussing guage portion and prevent rolling.

766,740. Edward H. Strange and Edward Graham, London, England. **Paint.** Crude rosin oil is heated with lime, a compound of manganese, and afterwards with litharge.

766,771. Solon O. Richardson, Jr., Toledo, Ohio. Making **glass.** A continuous process consisting in supplying the batch to a chamber, reducing the same therein by external heat, conducting the resultant product to a plaining chamber pending the reduction, external heat being applied to the plaining chamber, partially plaining said product in said plaining chamber and conducting the mass to a receiving chamber where it is exposed to direct heat and maintained in a fluid condition.

766,781. Maximilian Toch, New York, N. Y. **Lining for metal.** Iron free cement 70, magnesium carbonate and silica 10 each, calcium oxide 6, and albumen 5, and water enough to make 1 gallon for each six pounds.

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766,815. Thomas A. Edison, Llewellyn Park, N. J. **Primary battery electrode.** A compressed mass of finely divided black oxide of copper, having a film of finely divided red oxide of copper on its surface.

766,832. **Food compound.** Wm. R. Long, Peoria, Ill. Sugar is heated with an extract of caramel malt to about 270° F., reducing the temperature to about 250° F., and stirring the mixture till crystallized.

766,834. Dorothea Markfeld, Homestead, N. J. **Artificial fuel.** Compressed dry garbage 21, coal dust 8, fatty waste 2, lime, lampblack and cement 1 each, carbolic acid ¼ part for two parts of the mixture.

766,839. James B. Olney, New York, N. Y. Assignor to John H. Bell, Brooklyn N. Y., of one-half. **Bowling balls.** Sodium silicate 20, precipitated chalk, iron filings and fibers 2 parts each.

766,841. Wm. B. D. Penniman, Baltimore, Md. **Heating by low pressure steam.** Steam is drawn in two streams from a supply and one is superheated then mixed with the other in regulated quantities to produce the desired working temperature, and then condensed.

766,842. Edward E. Pray, Plainfield, N. J. **Antiseptic wall paper.** Creosote is used as the diluent or vehicle for the colors or inks used in making the wall paper.

766,938. Orvis G. Diefendorf, Watertown, N. Y. Making **brick.** A mixture is made of clay, cement, friable earth, color and a little water, they are then formed and pressed at about 2000 pounds to the square inch that brings the moisture to the surface, then drying to a crust on the outside, wetting them and further drying.

766,984. Virginia F. Beede, Stockton, Cal. **Hair restorative.** Extract of henna leaves, 400, aromatic spirits ammonia 8, Fowlers solution 8, alcohol 16, and oil of rose geranium 1 part.

767,054. Hiram N. Hanmore, Los Angeles, Cal. **Bricks.** Diatomaceous earth, calcium oxide and aluminum clay, the first in excess of the second, and the second more than the third.

767,065. Wm. A. Koneman, Chicago, Ill. Making **plaster of Paris.** Pulverized gypsum is calcined and dehydrated, then pulverized so as to make fine plaster, but leave the other materials in a coarser state, so they can be separated by sieving.

767,068. George Lanzendorfer, Boston, Mass. **Shaping fabrics.** A fabric is put on a form having in part a finishing surface, and is shrunk to that surface by a mercerizing solution of caustic alkali.

767,069-70. August L. Laska, Offenbach-on-Main, Germany. Assignor to K. Oehler, same place. **Brown dyes.** The first has sulphoconjugated diazonaphtalene combined with *m*-hydroxydiphenylamine. A dark brown powder soluble in water and sulphuric acid, and dyeing wool brown with chromium. The second combines in acid solution *m*-hydroxydiphenylamine with the sulphonic acids of heteronuclear diazo naphthols. Black-brown powders soluble in water, yellow-brown in sulphuric acid, violet, dyeing wool from acid baths, orange to violet shades turning red-brown to brown-violet on chroming.

767,110. Robert A. Hadfield, Sheffield, England. **Magnetic materials.** The process of making a material of high permeability and low hysteresis, which consists in alloying iron with silica or phosphorus 1 to 8 per cent., forming a thin body, heat-

ing it just below the melting-point, cooling quickly, heating it hotter than before, and again cooling.

767,114. Armand Muller Jacobs, Richmond Hill, N. Y. **Stearamide mordant.** Stearamide dissolved in alcohol, etc., and combined with aniline colors.

767,195. James S. Zerbe, New York, N. Y. **Electrical purification of water.** The water is first passed between soluble electrodes of aluminum, then upwards through an ozonizing chamber, where it is treated with ozone developed in the electrical chamber, then taking the water outside of the filtering chamber to remove coagulum and leading the ozone to the interior of the filtering chamber. One-half ampere per gallon per hour, at 6 to 110 volts is sufficient.

767,211. Nancy J. Dobbins, Los Angeles, Cal. **Egg preserving compound.** Sheet gelatin 5, cold water 16, sugar and gum tragacanth ⅛ part each by weight.

767,259. Rene Bohn, Mannheim, Germany. Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhein, Germany. **Anthracene dye.** Diaminoanthraquinones are melted with caustic potash forming grey dyes that are brown-black powders insoluble in water but giving brown solutions in caustic soda and sodium hydrosulphite, and dyeing cotton brown shades turning grey on exposure to the air.

767,279. Thomas H. Jackson, Montclair, N. J. **Cleaning fluid.** Powdered white castile soap 30, sal soda 25, starch 5, borax 10, spirits of rosemary 10, and water 500 parts.

767,289. Wm. Kirkwood, Chicago, Ill. **Hydrogen gas generator.** A vertical cylinder provided with pressure guage and delivery pipe has a partition in the middle on which the zinc, etc., rests, a pipe depending from the center of this portion open into the upper chamber, the lower chamber being partly filled with dilute acid, and connected with a pressure pump whereby the liquid can be raised through the tube to make contact with the zinc.

767,291. Emil Knoevenagel, Heidelberg, Germany. **Odoriferous compound.** Citral and aceto-acetic ester are condensed and heated to a high temperature for several hours, then inverted with sulphuric acid, the product poured on ice, absorbed by ether, distilled with steam, separated from the water and fractionally distilled.

767,339. Henry F. Hiller, So. Dartmouth, Mass. **Brazing cast iron.** A fluid is made of carminic acid and calcium carbonate 1 each, boracic acid 8, and water 32, this is applied to the surfaces and heated, then boric acid is put on, and finally brass-copper spelter. The heat is sufficient to melt the spelter before its application.

WILLIAM H. SEAMAN.

# REVIEW OF AMERICAN CHEMICAL RESEARCH.

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## GENERAL AND PHYSICAL CHEMISTRY.

**The Physical Properties of Aqueous Salt Solutions in Relation to the Ionic Theory.** BY ARTHUR A. NOYES. *Science*, 20, 577–587; *Tech. Quart.*, 17, 293–307.—This is an address that was delivered before the Physico-Chemical Section of the Congress of Arts and Sciences in St. Louis. The results of a critical study of the existing data relating to the subject named in the title, in the opinion of the author, warrant the statement of the following empirical principles:

(1) The transference number, or ratio of the conductivity of one ion to the sum of the conductivities of both ions, is constant within 1 per cent., between the concentrations of 1–200 and 1–10 normal, for all salts thus far accurately investigated, except lithium chloride, the halides of bivalent metals and cadmium sulphate.

This principle holds true, according to the results of various investigators, in the case of potassium and sodium chlorides, hydrochloric and nitric acids, silver nitrate, barium nitrate, potassium sulphate and copper sulphate—thus in the case of salts the three different ionic types.

(2) In case of the two uni-univalent salts and the three uni-bivalent salts hitherto carefully investigated, the ionization values derived from freezing-point lowering do not differ from those derived from conductivity, between the concentrations of 1–200 and 1–4 normal, by more than 2 or 3 per cent.

The five salts referred to are potassium and sodium chlorides, potassium and sodium sulphates, and barium chloride. The two sets of values for potassium chloride, for which an abundant experimental material exists, exhibit no pronounced or syste-

matic differences; but for the other four salts the freezing-point leads to values which are in general from 2 to 3 per cent. higher at all concentrations than the conductivity ratio.

(3) When the conductivity-ratio is assumed to represent the degree of ionization of the salts at all intermediate concentrations, the calculated values of the electromotive force of concentration cells exceed the measured ones by only about 1 per cent. in the case of potassium and sodium chloride between the concentrations of 1–600 and 1–20 normal. The measured electromotive force corresponds to an ionization value at the latter concentration about 1 per cent. less than the conductivity ratio.

(4) The measured heat of solution in the case of potassium perchlorate (the only salt thus far accurately investigated) is less by only 1.1 per cent. than that calculated under the assumption that the conductivity ratio is equal to the degree of ionization. The measured heat of solution corresponds to an ionization value 2.5 per cent. lower than the conductivity ratio.

The small deviations of the results obtained by the three methods of comparison lie in opposite directions, the freezing-point lowering corresponding to larger values of the ionization, and the measured electromotive forces and heat of solution to smaller ones than the conductivity-ratio.

(5) From a theoretical standpoint these three methods are based on the same hypotheses, namely, that the osmotic pressure constant for ions and un-ionized molecules is identical with the gas-constant; that the conductivity-ratio is a correct measure of ionization, and that complex molecules or ions are not present in the solution. The concordance of the results furnishes, therefore, a strong confirmation of the correctness of these fundamental hypotheses.

(6) The degree of ionization of salts, whether derived from the conductivity-ratio or from thermodynamic relations involving the equality of the osmotic pressure constant and the gas constant does not vary with the concentration even approximately in accordance with the law of chemical mass action.

(7) The apparent thermodynamic inconsistency of these conclusions is removed by assuming that the separation of un-ionized molecules from ions involves the expenditure of other work than that corresponding to their osmotic pressures.

(8) The un-ionized fraction of a salt as determined from the conductivity ratio is proportional to the cube-root of its total concentration or to that of its ion-concentration, between 1–2000 and 1–10 normal, in the case of both uni-univalent and uni-multivalent salts. That is, $1 - \gamma = Kc^{\frac{1}{3}}$ or $1 - \gamma = K(c\gamma)^{\frac{1}{3}}$ where $\gamma$ is the degree of ionization, $c$ the concentration and $K$ a constant. The average deviations of the actual measurements from the values corresponding to the latter function are $\frac{1}{4}$ to $\frac{1}{3}$ per cent.

(9) In the case both of uni-univalent and uni-bivalent salts

between the concentrations of 1–10000 and 1–5 normal, the concentration of the un-ionized molecules is proportional to the concentration of the ions raised to a constant power, varying somewhat with the salt and the temperature, but as a rule only between the limits of 1.43 and 1.56. That is, $c(1 - \gamma) = K(c\gamma)^n$, where $n > 1.43$ and $< 1.56$.

(10) The applicability to the salts of different types of either of these two preceding principles leads to the important conclusion that the form of the concentration function is independent of the number of ions into which the molecule of the salt dissociates. This seems to show almost conclusively that chemical mass action has no appreciable influence in determining the equilibrium between ions and un-ionized molecules.

(11) The conductivity and the freezing-point lowering of a mixture of salts having one ion in common are those calculated under the assumption that the degree of ionization of each salt is that which it would have if present alone at such an equivalent concentration that the concentration of either of its ions were equal to the sum of the equivalent concentrations of all the positive or negative ions present in the mixture.

For example, suppose that a mixed solution is 0.1 normal with respect to sodium chloride and 0.2 normal with respect to sodium sulphate, and that it is 0.18 normal with reference to the positive or negative ions of these salts. The principle then requires that the ionization of either of these salts in the mixture be the same as it is in water alone when its ion-concentration is 0.18 normal.

Experiments confirming, within the small experimental error of the determinations, this principle in regard to the conductivity of mixtures up to a concentration of at least 0.5 normal have been made upon eight pairs of uni-univalent salts and with mixtures of potassium and sodium sulphates, potassium and copper or magnesium sulphates (up to 0.1 normal), potassium sulphate and chloride, barium and sodium chlorides, and zinc and copper sulphates—thus for almost every possible typical combination of uni-uni, uni-bi and bi-bivalent salts. The same principle is true of the freezing-point lowering shown by mixtures of potassium and sodium sulphate. The law of chemical mass action here again shows itself entirely inapplicable to the phenomena connected with the ionization of salts.

(12) The following rules, unlike the preceding principles, are only crude approximations, and to these there are some marked exceptions: 1, the decrease of ionization with increasing concentration is roughly constant in the case of different salts of the same type; and 2, the un-ionized fraction at any definite molal concentration is roughly proportional to the product of the valences of the two ions in the case of salts of different types.

(13) The simultaneous validity of the two solubility principles is quite inconsistent with the above stated principle in regard

to the ionization in mixtures. In fact, assuming that principle to be correct, the existing data lead to the conclusion that the hypothesis that in a (not too concentrated) saturated solution the un-ionized molecules of the salt always have the same concentration is not even approximately true. Thus when thallium chloride and bromate, each of which alone has a solubility of about 1-40 normal in water at 40°, are simultaneously present as solid phases, the solubility of each is reduced by the other to an extent which shows that the concentration of the un-ionized molecules is diminished by about 15 per cent. The product of the ion-concentrations varies much less, if at all; thus in the instance just cited this product is found by calculation to have increased 5 per cent.

(14) The optical activity and the color of salts in solution, when referred to equivalent quantities, are independent of the concentration and therefore of the degree of ionization of the salts and are additive with respect to the properties of the constituent ions even up to concentrations where a large proportion of the salt is in the un-ionized state.

The experimental evidence in support of these principles is partially referred to in the article, but is to be presented in full in a later publication. A. A. NOYES.

**International Electrical Congress.** *Electrochemical Industry*, October, 1904.—Reviews are given of the following papers, more or less interesting to chemists: "The Relation of the Hypothesis of Compressible Atoms to Electrochemistry," by Prof. T. W. Richards; "Electrical Extraction of Nitrogen from the Air," by J. S. Edstrom; "The Chemistry of Electroplating," by W. D. Bancroft; "The Carbon Cell," by Prof. H. Haber and Dr. L. Bruner; "The Electrochemical Series of Metals," by L. Kahlenberg; "The Lead Coulometer," by A. G. Betts and E. F. Kern; "Chlorine in Metallurgy," by J. Swinburne; "Aluminothermics," by H. Goldschmidt; "The Silver Voltameter," by K. Guthe; "Materials Used in Standard Cells and Their Preparation," by H. S. Carhart; "Electrometallurgy of Iron and Steel," by P. L. T. Heroult; "Present Status of the Edison Battery," by A. E. Kennelly and S. E. Whiting; "Electrolytic Conduction," by J. W. Richards; "Electrolysis of Fused Salts," by Prof. R. Lorenz; "Electrolysis and Catalysis," by Prof. W. Ostwald; "Deposition of Aluminium from Ethyl Bromide Solutions," by H. E. Patten; "The Aluminium Rectifier," by W. D. Bancroft; "Aspects of Applied Electrochemistry," by W. McA. Johnson; "Testing the Temperature of Electric Furnaces," by F. A. J. Fitzgerald; "Electrolytic Separation of Cobalt from Nickel," by W. D. Bancroft; "Electrolytic Rectifiers," by A. Nodon; and "Aluminium Conductors," by H. W. Buck. J. W. RICHARDS.

## INORGANIC CHEMISTRY.

**On the Rate of Crystallization of Plastic Sulphur.** By J. H. Kastle and Walter P. Kelley. *Am. Chem. J.*, 32, 483.—The results of a great number of experiments are presented, in which the authors record the rates of change in specific gravity and in volume (by dilatometric method) which plastic sulphur, prepared by pouring liquid sulphur at various temperatures, shows in passing to the crystalline variety, under different conditions of temperature and tension, and in contact with various liquid media; *e.g.*, water, ammonium hydroxide, alcohol, etc.

From observations of the rates of change of specific gravity of plastic sulphur prepared from sulphur at 200° and at 440°, it was found that, in contact with water at temperatures ranging from the ordinary room temperature to 80°, the rate of change to the crystalline variety diminished with the degree of supercooling, and increased with the temperature at which the plastic sulphur was kept. Ammonium hydroxide, alcohol and bromine water accelerated the change to the crystalline form, while iodine retarded it. Tension, that is, the stretching of strands of plastic sulphur, increased the rate of crystallization.

It was found that plastic sulphur has no definite melting-point. When plastic sulphur is heated until it melts, a dark-colored fusion results, which is about as deep in color as N/10 iodine. A pale, straw-colored liquid is formed when orthorhombic crystals are fused. The authors found that the differences in color disappeared, if the two liquids were heated in melting-point tubes for a sufficient time at a temperature of 120°-125° (five hours); both liquids became pale reddish brown. This indicates a condition of chemical equilibrium which is ultimately reached by applying heat to the system.

By means of a dilatometer the contractions which accompany the change of plastic to crystalline sulphur were measured. It was found that for successive intervals of five minutes there was a gradual decrease in the amount of contraction. The calculated coefficient of velocity showed that a falling off in the velocity of change amounted to about 10 per cent. in thirty minutes. The authors conclude that this gradual diminution in the rate of crystallization harmonizes with the view that in plastic sulphur, a supercooled liquid, "there are probably several molecular species, some of which pass to the crystalline variety of the element more rapidly than others." Lauder W. Jones.

**Perchromic Acid and the Perchromates.** By Horace G. Byers and E. Emmet Reid. *Am. Chem. J.*, 32, 503.—Following a historical summary of the past views concerning the composition and constitution of the blue compound soluble in ether, which is formed when acidified chromate is treated with hydrogen peroxide, the authors present experimental evidence which points

to the formula $H_2Cr_2O_8$ (or $HCrO_4$) as the correct one for this blue compound.

Very unstable salts of this acid were prepared at a temperature of —20°. The potassium salt was obtained in several different ways: first, by the action of metallic potassium upon an ether solution of the blue compound, cooled by ether and solid carbon dioxide; second, by the action of an ether solution of potassium hydroxide upon the blue solution; third, by the use of an alcoholic solution of potassium cyanide. The potassium salt is a purplish black substance which yields with water a sherry wine-colored solution. If an acid is added to this solution in the presence of ether, the blue compound is regenerated. The solution in water soon decomposes, and yields a chromate.

An analysis of the potassium salt, prepared by the action of potassium, points to the formula $K_2Cr_2O_8$ (or $KCrO_4$). Similar results were obtained with sodium. It was found that salts of the blue compound could easily be obtained by adding solid acetates to the cold, blue, ethereal solution. In this way mixtures of acetate and perchromate salts were formed, which were analyzed. The results obtained with the sodium, lithium, magnesium calcium, barium, and zinc salts showed them to be salts of an acid $H_2Cr_2O_8$ (or $HCrO_4$).

It appears from their results that the blue ether solution, prepared without excess of hydrogen peroxide, contains an acid, $H_2Cr_2O_8$. If a larger excess of hydrogen peroxide is used, the authors think higher oxygen acids of chromium are present.

LAUDER W. JONES.

**The Constitution of Hydrous Thallic Chloride.** BY F. M McCLENAHAN. *Ztschr. anorg. Chem.*, **42**, 100.—The author considers the changes which hydrous thallic chloride, $TlCl_3.4H_2O$, suffers when it is heated in air and in gaseous hydrochloric acid. He discusses these results from the standpoint of the hypothesis of quadrivalent oxygen, which Cushman (*Am. Chem. J.*, **24**, 222; **26**, 505) proposed to account for the behavior of certian hydrous chlorides towards heat.

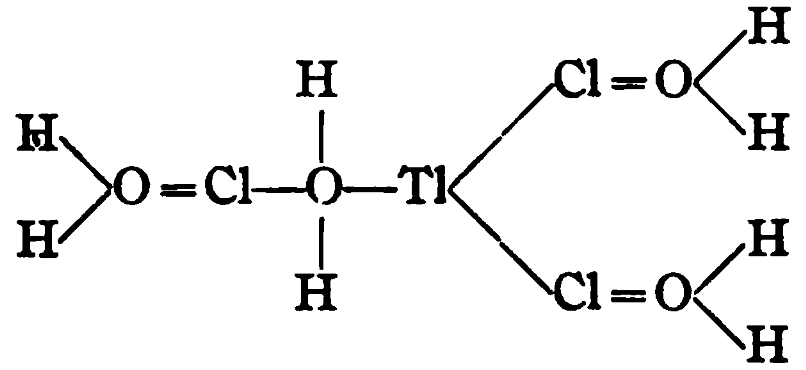
When hydrous thallic chloride was heated to 100° in a current of dry air, the author obtained thallic chloride which was almost anhydrous, and showed a loss of chlorine which amounted to about 1 per cent. A series of experiments were made with hydrous thallic chloride in an atmosphere of hydrochloric acid, and of air at temperatures ranging from 35°-120°. The results are presented in tables, and represented graphically by curves. McClenahan found that at all temperatures below 100° there was an absorption of hydrochloric acid. This he attributes to the formation of a salt, $TlCl_3 3H_2O.HCl$, observed by Meyer. (*Ztschr. anorg. Chem.*, **32**, 72).

In an atmosphere of hydrochloric acid, the following changes were noted:—

| Temperature. | Composition of residue. |
|---|---|
| At 50°–70° | $TlCl_3.3H_2O.HCl$ |
| 80° | $TlCl_3.3H_2O.HCl$ begins to change to $TlCl_3.H_2O.HCl$ |
| 100° (1 hour) <br> 110° (½ hour) | $TlCl_3.H_2O.HCl$ (possibly $TlCl_3.3H_2O.HCl+TlCl_3.H_2O$) |
| 115° (½ hour) | $TlCl_3.H_2O$ |
| 120° | $TlCl_3$ (trace of thallous chloride). |

These results, compared with the results obtained in air, show that the dehydration proceeds more slowly in an atmosphere of hydrochloric acid.

Experiments were next made with the hydrous salt, $TlCl_3.2H_2O$, which McClenahan prepared by the careful dehydration of $TlCl_3.4H_2O$ over calcium chloride. The dehydration of this salt showed that at 100° the first molecule of water passes off more easily (5.2 per cent.) than the second, a fact which leads the author to conclude that the molecules of water in $TlCl_3.4H_2O$ are combined in three different ways. He proposes the following constitutional formula:



LAUDER W. JONES.

**The Elements: Verified and Unverified.** BY CHARLES BASKERVILLE. *Proc. A. A. A. S.*, December, 1904, January, 1905.—At the close of an address in which an interesting discussion of the meaning of the term "element" is presented, and a criticism of the methods at present employed in verifying elements, the author gives a table of elements, verified and unverified, which is surprising in its completeness and fulness of detail. The table includes somewhere in the neighborhood of two hundred elements, or proposed elements, arranged chronologically in the order of their discovery. The facts concerning each one are presented in columns with the following headings: Date of Discovery, Name of Element, Source, Authority, References to Literature, Remarks.

The list is brought down to the year 1904.

LAUDER W. JONES.

## MINERALOGICAL AND GEOLOGICAL CHEMISTRY.

**Description of the Kittanning [Pennsylvania] Quadrangle.** BY CHARLES BUTTS. *U. S. Geol. Survey, Geol. Atlas of the United States, folio* 115.—Appended to the geological descriptions are several analyses of coals, most of them made recently by chemists of the Geol. Survey. W. F. HILLEBRAND.

**The Geology of the Perry Basin in Southeastern Maine.** By GEORGE OTIS SMITH AND DAVID WHITE. *U. S. Geol. Survey, Professional Paper No.* 35, 107 pp.; map, plates.—This report gives the results of investigations of alleged coal deposits in the Perry Basin and elsewhere in Maine. Although altogether negative as regards coal, in other respects facts of geological importance were brought to light. W. F. HILLEBRAND.

**Mineral Production of Iowa in 1902.** By S. W. BEYER. *Iowa Geol. Survey, Vol.* 14, *Ann. Rep.*, 1903, pp. 7-26.

**Mineral Production of Iowa in 1903.** By S. W. BEYER. *Iowa Geol. Survey, Vol.* 14, *Ann. Rep.*, 1903, pp. 644-655.

W. F. HILLEBRAND.

**Clays and Clay Industries of Iowa.** By S. W. BEYER, G. W. BISSELL, I. A. WILLIAMS, J. B. WEEMS AND A. MARSTON. *Iowa Geol. Survey, Vol.* 14, *Ann. Rep.*, 1903, pp. 27-643; plates.—This is an addition to the already considerable list of State Survey publications dealing with the local clay resources. Chapter V, on the "Chemistry of Clays," by J. B. Weems, is the only one which has been particularly considered by the reviewer, who feels impelled, in the interest of chemistry at large, to comment somewhat freely upon it. It is very questionable if such brief outlines of complicated procedures serve any useful purpose, even when they are above criticism as to their substance and the manner of presentation. But when errors abound, and are of the character of some of those in this chapter, the question of utility is no longer debatable. It were far better that the money spent in expensive publication had been devoted to some other purpose. The quotations following, are from the section "Chemical Analysis of Clays." "Determination of iron.—Fuse the precipitate of aluminum and iron oxide with $Na_2CO_3$, and treat the fused mass with water. Wash into a small beaker and decant off the clear liquid into the flask used for the determination of iron volumetrically, and determine in the usual manner" (p. 335). If this be but careless writing, what shall be said of the following direction for the determination of ferrous oxide on page 339? "Ferrous oxide can be determined by fusing one-half gram of clay with five grams of sodium carbonate. The clay in the crucible should be well covered with carbonate. The contents are heated, the crucible being covered. The fused mass is dissolved and mixed with hydrochloric acid and sulphuric acid in an atmosphere of carbon dioxide. Ferrous iron is determined by titration with standard permanganate." In the directions for the determination of alkalies, on page 337, no provision is made for the removal of lime or magnesia, so that the weights reported for alkali chlorides must represent all the calcium and magnesium of the clay, as well as the alkali metals, and furthermore,

must represent them largely in the form of sulphates. It is to be hoped that the numerous analyses scattered throughout this report on Iowa clays were not made with rigid adherence to the rules laid down in Chapter V, which in other respects stands in need of much editorial revision. W. F. HILLEBRAND.

**The Comparative Accuracy of the Methods for Determining the Percentages of the Several Components of an Igneous Rock.** BY IRA A. WILLIAMS. *Am. Geologist*, 35, 34-46.—The subject indicated by the title was studied by tests upon the relatively coarse-grained pink granite from Westerly, Rhode Island, since, for well-known reasons, a fine-grained rock could not yield satisfactory data. The methods employed were calculations based on: (*a*) The results of chemical analysis; (*b*) separation of the mineral constituents by a heavy solution; (*c*) microscopical measurement of the diameters of grains in thin section, and (*d*) of their areas; (*e*) photographs of microscopic fields, then cutting out and weighing, from prints thus secured, the areas of the various constituents; (*f*) volume percentages, obtained by means of the data of *e*. The gist of the author's conclusions is that for rocks of simple and easily determinable mineral composition, the methods *a* and *b* can give close approximations, while none of the microscopical methods appears capable of affording even approximations to the actual mineral composition. Methods *c* and *d* agree closely with each other, but vary widely from the former. For this special case, *e* shows in most respects good agreement with *c* and *d*. The paper contains also some quantitative data relative to the loss of light-colored and dark constituents, resulting from careful crushing and rejection of the fines that do not settle in water. These show, as might be expected, a much greater proportional loss of the light-colored (also as a rule, specifically lighter) constituents. W. F. HILLEBRAND.

**The Origin of Bitumen.** BY W. C. MORGAN. *California J. of Technology*, 4, 49-50, and *Am. Geologist*, 35, 46-50.—The author reviews and comments briefly on the theories of inorganic and organic (vegetable and animal) origin of bitumen, and refers to the discovery of this substance in a fossil egg (this Journal, 27, R. 122) as affording the first proof that animal matter can furnish bitumen under conditions obtaining in nature and at temperatures little, if any, higher than the ordinary.

W. F. HILLEBRAND.

**New Mexico Mines and Minerals.** BY FAYETTE ALEXANDER JONES. 346 pp.; illustrated.—This volume, prepared and issued as a "World's Fair Edition, 1904," contains besides the usual historical and statistical matter of such publications, a good many analyses of waters, coals, salts, etc., some of which may not have before appeared in print. There is also a list of all the hitherto

noted metallic minerals of the territory and of many of the silicates.
W. F. HILLEBRAND.

**The Gypsum of Michigan and the Plaster Industry.** BY G. P. GRIMSLEY. *Geol. Survey of Michigan*, Vol. 9, Part II, ix + 246 pp.; maps, plates, figures.—This seems to be a valuable contribution to our knowledge of one of the most important sources of Michigan's wealth. Besides chapters of geological, historical, and descriptive character, there are others on the chemical composition, the theories of origin of the Michigan deposits (see this Journal, **27**, R. 121), on gypsum as a fertilizer, the numerous uses of both the raw and calcined mineral, and the physical examination of gypsum plasters. In this last chapter special attention is paid to the tensile, compression, and adhesion tests of plasters, which have occupied the author for a period of two years, a subject which has hitherto been rather neglected. Appendix B is a bibliography of all works so far found by the author, which treat in any way of gypsum. The report is replete with analyses of both the natural and finished products.
W. F. HILLEBRAND.

**Petrograpy and Geology of the Igneous Rocks of the Highwood Mountains, Montana.** BY L. V. PIRSSON. *U. S. Geol. Survey, Bull.* 237, 208 pp.; maps, plates.—The author, in conjunction with Mr. W. H. Weed, has already published several papers dealing with points of special interest in the above area (see Bull. Geol. Soc. Am., **6**, 389, and this Journal, **19**, R. 65, and **24**, R. 122). The present report presents a far more thorough treatment of the very characteristic rocks of this group of old, eroded volcanoes than could be given in the preliminary papers. Especially interesting are the views expressed in the section dealing with differentiation in laccoliths, in which the several theories advanced to account for magmatic differentiation are discussed and criticized. For the particular cases in question the author now adopts, with slight modifications, the views of G. F. Becker, "that a combination of convection currents and the tendency to crystallize first at the outer walls of the laccolithic chamber may possibly be sufficient causes" to account for the observed facts; but he is not so certain as to the processes which produced the evident differentiations in the stocks and dikes. With regard to differentiation in general, the author says: "As time goes on it becomes more and more evident that the problem is an increasingly perplexing one; no single explanation of one occurrence will do for all;" and again, "The truth of the matter is, that we are not as yet at all prepared to give a general explanation of the differentiation of magmas." W. F. HILLEBRAND.

**Zinc and Lead Deposits of Northwestern Illinois.** BY H. FOSTER BAIN. *U. S. Geol. Survey, Bull. No.* 246, 56 pp.; maps,

plates, figures.—After a brief historical statement follow descriptions of the geology of the region and of the deposits, of the nature of the deposits and their mode of occurrence, and of the mines and prospects. No new views are advanced as to the origin and process of concentration of the ores, but the alternative theories of Chamberlin and Van Hise as to the latter are succinctly reviewed and discussed. W. F. HILLEBRAND.

**The Replacement of Quartz by Pyrite.** BY CHARLES S. PALMER. *Eng. Min. J.*, 79, 169.—To explain such actually observed replacement the author suggests the action of hypothetical sodium meta-sulphoferrite, $Na_2Fe^{IV}S_3$, at a temperature of between 100° and 200° C. ($SiO_2 + Na_2Fe^{IV}S_3 + H_2O = Na_2SiO_3 + H_2S + Fe^{IV}S_2$). The possibility is favored by the existence of such artificial salts as $Na_2Fe^{II}Fe^{IV}S_4$, disodium-ferrous normal-sulphoferrite, and the silver and cadmium normal sulphoferrites. Further research on the behavior of silica and pyrite in hot alkaline solutions is suggested. W. F. HILLEBRAND.

**Formation of Iron Pyrite in Gravels.** By R. H. STRETCH. *Eng. Min. J.*, 79, 238.—The author refers to an occurrence of this kind, near Nevada City, California, about a tree trunk and among the petrified remains of great quantities of vegetation. A similar origin, due to the reducing action of local accumulations of seaweed, is suggested for certain beach deposits of pyrite.
W. F. HILLEBRAND.

**The Geology of the Cerillos Hills, New Mexico. II. Petrography.** BY D. W. JOHNSON. *School of Mines Quart.*, 25, 69–98; plates.—See this Journal, 26, R. 51, for references to an earlier portion of this paper. The Cerillos region shows the following series of eruptives, in order of their relative age: Mica andesite, eruptive breccias, hornblende andesite, augite andesite, olivine basalt. These, with various varieties, are all described, but the only one represented by an analysis (Geo. Steiger, analyst), is a gabbro-porphyry (andose) from Mt. McKensie. In this the silica is unusually low (48.21 per cent.) for an andesite. From his extended examinations the author is quite unable to believe that the analysis of the turquoise matrix by Clarke and Diller, in 1887, with its high potash, can represent the usual character of that rock. He is convinced of its original identity with the surrounding augite andesite. W. F. HILLEBRAND.

**Geology of the Vicinity of Little Falls, Herkimer County.** BY H. P. CUSHING. *New York State Museum, Bull. No.* 77, 95 pp.; maps, plates. W. F. HILLEBRAND.

**The Geology of Michipicoten Island.** BY E. M. BURWASH. *Univ. of Toronto Studies, Geol. Series No.* 3, 48 pp.; maps, plates.
W. F. HILLEBRAND.

**Report on the Origin, Geological Relations and Composition of the Nickel and Copper Deposits of the Sudbury Mining District, Ontario, Canada.** BY ALFRED ERNEST BARLOW. *Geol. Survey of Canada, Vol.* 14, *Part H*, 236 pp.; maps, plates.—In addition to the subject-matter of the title, which is treated in a very thorough manner, and includes a bibliography with summary of contents of all important papers, relating to the District, that have appeared in print, there are "brief references to the character and extent of all the more important nickel deposits of the world, with a general statement of their production and methods of smelting and refining. Detaiİs of the mining, smelting and refining operations of the Sudbury ores are furnished, as well as complete statistical tables of production, prices, uses and compositon of the nickel of commerce."

W. F. HILLEBRAND.

**The Isomorphism and Thermal Properties of the Feldspars.** BY ARTHUR L. DAY AND E. T. ALLEN. *Am. J. Sci.*, 19, 93–142; figures, plate.—The reviewer is indebted to one of the authors for the greater portion of the following abstract. This is the first important paper from the new Geophysical Laboratory, which was established by the Geological Survey in 1900, and greatly enlarged through the assistance of the Carnegie Institution about a year ago. The attempt has been made to carry through a quantitative study of the soda-lime feldspar series, upon artifically prepared, chemically pure specimens, in quantities sufficient for thorough identification, microscopically and chemically. The products proved optically identical with the natural feldspars in every instance. They have been studied with great care by a method based on the principle of Frankenheim, with the most perfect apparatus which has yet been used in researches of this character. It was sought to make all the observations independent of the personal equation. All the studies of the change of state of these feldspars have been made, heretofore, by having the sample watched by an observer, and the temperature recorded at the time when it appeared to melt. When applied to materials of high viscosity, such as the feldspars, this method obviously depends upon the judgment of the observer rather than upon the measurements of a physical constant. The specific gravity determinations were made upon fine powder in water, by the pycnometer method, with special precautions with regard to evaporation of water around the stopper, constant temperature, freedom from adhering air, etc. With these precautions the error is not greater than $\pm 0.001$. The following table gives the melting-points and densities determined, the former being far higher than those found by earlier observers.

| Feldspar. | An. | $Ab_1An_5$. | $Ab_1An_2$. | $Ab_1An_1$. | $Ab_2An_1$. | $Ab_3Ab_1$. | Ab. |
|---|---|---|---|---|---|---|---|
| Melting temp........... | 1532° | 1500° | 1463° | 1419° | 1367° | 1340° | |
| Sp. gr. (cryst.)......... | 2.765 | 2.733 | 2.710 | 2.679 | 2.660 | 2.649 | 2.605 |
| Sp. gr. (glass).......... | 2.700 | 2.648 | 2.591 | 2.533 | 2.483 | 2.458 | 2.382 |

The authors conclude: (1) That the feldspars form an isomorphous series, falling under type 1 of Roozeboom's classification, that the portion which crystallizes out has the same chemical constitution as the vitreous matrix in every case, which is explained by the extreme viscosity and consequent undercooling in all the melts, before crystallization begins. (2) That the curve of the melting-points follows Küster's rule (straight line) rather than Van't Hoff's assumptions regarding solid solutions. (3) That the specific volume curve is a straight line. (4) That albite and microcline, and some other hyperviscous minerals, do not melt at a single temperature for a given pressure, but over a range of temperature, as in the case of transformations from one solid phase to another. It is possible to pass the melting-point in either direction; that is, we may not only have undercooling, but a metastable stage in which crystalline feldspars exist for hours or days above the point where melting begins, without derangement of the crystalline orientation. (5) That viscous and poorly conducting melts undercool several hundred degrees and do not give a constant solidifying point under any conditions which can be imposed. The lowering of the solidifying point, which is of value in the study of aqueous solutions, cannot be applied here. (6) That powdered feldspar glasses sinter readily as low as 700°. Dry crystalline feldspars also sinter some 150° below their melting temperature, probably due to slow sublimation. (7) That powdered feldspars when exposed, adsorb moisture in quantities of the order of magnitude usually given for the water reported in feldspar analyses. It is, therefore, possible that the moisture usually found has been misinterpreted.

W. F. HILLEBRAND.

**The Doughty Springs, A Group of Radium-bearing Springs on the North Fork of the Gunnison River, Delta County, Colorado.** BY WM. P. HEADDEN. *Proc. Colorado Sci. Soc.*, **8**, 1–30; plates.—These sulphur springs have hitherto been wholly unknown to the general public, though there is evidence that they were formerly in repute among the Indians for their healing qualities. They issue near the base of a cliff and have deposited a sinter bed, 400 by about 115 by 20 feet, between the cliff and the stream. With one exception, where special conditions favored, no cones have been built up around their orifices. There is no evidence that they have ever been materially more active than at the present time. The aggregate outflow of water is large, but no one spring furnishes a notably large supply. The waters of most of the springs are milky, due not so much to sulphur as to freshly precipitated barium sulphate, this being supposedly caused by the mingling near the surface of other waters with those carrying the barium. The author concludes that three types of water are represented by his analyses, which are six in number. Four of these are so similar that their composition may be represented

by a single analysis, that of the "Black Spring," as given in the table below, even though this water was clear, and that of the other three milky. The water of the "Drinking Spring" was clear, and is characterized by a high barium content. The "Alum Spring" yields a water of exceptional character, which forms deposits of mixed sulphates, but the analysis is not here reproduced, because incomplete, and, as published, affected by errors which the reviewer cannot correct.

COMPOSITION IN GRAMS PER LITER.

| Black Spring. | | | | Drinking Spring. | | | |
|---|---|---|---|---|---|---|---|
| Na | 1.1978 | Cl | 0.8157 | Na | 1.0571 | Cl | 0.7005 |
| K | 0.0589 | Br | 0.0147 | K | 0.0617 | Br | 0.0052 |
| Li | 0.0016 | I | trace | Li | 0.0031 | I | trace |
| $NH_4$ | 0.0013 | $SO_4$ | 0.2731 | $NH_4$ | 0.0012 | $SO_4$ | 0.6254 |
| Ca | 0.1261 | $SiO_3$ | 0.0235 | Ca | 0.1057 | $SiO_3$ | 0.0266 |
| Ba | none | $BO_2$ | 0.0001 | Ba | 0.0132 | $BO_2$ | 0.0075 |
| Sr | 0.0035 | $S_2O_3$ | 0.0108[1] | Sr | 0.0066 | $S_2O_3$ | not det. |
| Mg | 0.0609 | $CO_3$[2] | 1.0847 | Mg | 0.0394 | $CO_3$[2] | 0.6965 |
| Fe | 0.0012 | | 3.6825 | Fe | 0.0007 | | 3.3525 |
| Al | 0.0046 | Total $CO_2$ | 2.566 | Al | 0.0005 | Total $CO_2$ | 3.0800 |
| Mn | 0.0040 | Free $CO_2$ | 0.9772 | Mn | 0.0016 | Free $CO_2$ | 2.0584 |
| Zn | trace | Free $H_2S$ | 0.0492 | Zn | trace | Free $H_2S$ | 0.04717 |
| | | Sp. gr. | 1.004 | | | Sp. gr. | 1.0037 |

Most interesting is the sinter forming the ledge already mentioned. Having at its outer edge mainly the composition of a limestone with an admixture of a few per cent. of barite, it becomes nearly pure barite at some of the spring rims. Although the deposit formed about two of the springs is chiefly sulphur, this is markedly absent from the sinter as a whole. This is believed to be the first noted occurrence of a barite sinter as a spring deposit. The sinter is faintly radioactive towards a photographic plate on five days' exposure, but from 13 pounds of the sinter, the author was able to obtain without much trouble two ounces of radiferous barium chloride, which produced in two and a half days a strong, sharp negative, comparable with those made by pitchblende from Gilpin County, Colorado, or by carnotite. This sinter promises to be a valuable source of radium. The gases, the author believes, carry helium, but he was unable to test them.

W. F. HILLEBRAND.

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## METALLURGICAL CHEMISTRY.

**A Modern Metallurgical Laboratory.** BY R. H. BRADFORD. *Mines and Minerals*, December, 1904.—Illustrated description of a laboratory erected for the State School of Mines, at the University of Utah, Salt Lake City. The principal part of the building is a testing plant equipped with crushers, grinders, concentrators, magnetic separators, cyanide tanks, etc., for the testing of

[1] Approximate.

[2] Calculated for normal carbonates.

ores on a larger scale, so as to be of immediate practical service to the mining and metallurgical interests of the state.

J. W. RICHARDS.

**The Cleveland Furnace Company's Plant.** *Iron Trade Rev.*, December 22, 1904.—A long, illustrated description of a modern blast-furnace plant, including unloading and charging devices, furnace top, blowing-engines, and by-product coke plant.

J. W. RICHARDS.

**A New Blast-furnace Charging Device.** *Iron Age*, December 29, 1904.—Description of an apparatus devised by Backlund and Burman, in which the double bell and hopper are placed entirely above the furnace top platform, supported in a movable frame mounted on wheels, so that it can be wheeled directly away from the top of the furnace, if necessary to change or repair the hopper or to gain access to the inside of the furnace. A cylinder placed inside the top acts as a seal and carries the charges below the level of the gas outlet.

J. W. RICHARDS.

**Hardening Steel Electrically.** *Iron and Mach. World*, December 3, 1904 (from *El. Rev.*).—Three methods are described: (1) To use the tool as a cathode in a solution of sodium carbonate, and bring it up to the required heat by a high tension electric current, on the water-pail forge principle; when the desired temperature is reached the current is cut off, and the steel is instantly chilled. (2) Using the tool as a positive electrode and striking an arc to a carbon rod, the intensity of the arc being controlled by a rheostat; the method is rapid and allows of localizing the heating. (3) The tool is part of a secondary circuit of a transformer, and is heated by heavy induced currents; this requires heavy electrical apparatus, but the temperature is under exact control, without danger of oxidizing or carbonizing the tool.

J. W. RICHARDS.

**Steel Hardening Metals.** BY J. H. PRATT. *Iron Age*, December 1, 1904 (from Bull. U. S. Geological Surv.).—*Nickel and cobalt* are mined in the U. S. only at Mine La Motte, Mo., where there was produced, in 1903, 661 tons of matte, containing 114,200 pounds of nickel, worth $45,900, and 120,000 pounds of cobalt oxide, valued at $228,000. *Chromium* is being mined as chromite, California being the only producing state. The Willson-Aluminum Co. at Kanawha Falls, Va., make ferro-chrome, principally from ore brought from Asia Minor and New Caledonia. California produced 150 tons of chromite in 1903, valued at $2,250.00. *Tungsten* is mined at Dragoon, Ariz., and in Colorado. A vein four feet wide has been recently found near Cripple Creek. The concentrated ore is worth $100.00 to $250.00 per ton. There were 2451 short tons mined in 1903. *Molybdenum* is sold as an alloy with 25 per cent. nickel, or alloyed with 50 per

cent. iron. The Troy-Manhattan Copper Co., at Troy, Arizona, mine and concentrate wulfenite, lead molybdate; the American Molybdenum Co., at Cooper, Maine, has a concentrating plant. The concentrates are worth about $200.00 per ton. Much prospecting is being done. The output in 1903, was 795 tons of concentrates. *Uranium* and *Vanadium* are mined principally in Montrose Co., Colo., 432 tons of crude ore being mined in 1903, which was concentrated to 30 tons, sold at $5625.00. The ore is carnotite, containing only a small amount of uranium. *Titanium* is manufactured as ferro-titanium by the Willson-Aluminum Co., from titanic ore from Caldwell Co., N. C. J. W. RICHARDS.

**Cupola Tests with Fans and Pressure Blowers.** BY W. H. MCFADDEN. *Iron Trade Rev.*, December 8, 1904.—The cupola used was 54 inches inside the lining, the fan was a No. 10 Sturtevant, the blower a 33 cubic-foot Connersville blower. A 50 horse-power electric motor furnished the power. The fan, run at 839 revolutions per minute, required 35.8 horse-power consumed by the motor, and melted 28.84 tons of iron in three hours forty-six minutes, or 4.67 electric horse-power hours per ton of iron melted. The blower, run at 171 revolutions required 40.6 electric horse-power to drive the motor, and melted 29.8 tons of iron in two hours and forty-nine minutes, or 3.84 electric horse-power hours per ton of iron melted. The blower required more power altogether, but melted the iron in nearly one hour less time, so requiring less horse-power hours per ton of iron melted, and saving largely in time of melting. The temperature of the metal was the same in both cases; the blower caused greater wear on the cupola than the fan. Additional deductions are: (1) A 40 horse-power motor is sufficient to supply power for a 54-inch cupola. (2) The rate of melting is not proportionate to the amount of air supplied; too much air cools the cupola around the tuyeres, and reduces the melting area. (3) The cost of the positive blower is greater than that of the fan. (4) The number of revolutions per minute of the positive blower and the horse-power consumed by the fan are the only guides as to the amount of air being supplied to the cupola. J. W. RICHARDS.

**The Johnson Arch Plate.** *Iron Trade Rev.*, December 8, 1904.—A device in the form of a shield, which fits on the ram of the charging machine for open-hearth furnaces and fills up the charging door opening while workmen are repairing the arch above the same. It shields the workmen against the heat of the furnace so effectually that the door arch may be rebuilt while the furnace is in operation. It can be put in place in a few minutes, and is held in place by the charging machine until repairs are completed. J. W. RICHARDS.

**Hot Blast Generation.** BY H. HAAS. *Eng. Min. J.*, December 29, 1904.—A discussion of modern forms of iron-pipe hot-blast ovens used in copper smelting. A cupola 42 by 96 inches at the tuyeres will need some 7,000 cubic feet of air per minute, heated to 300° C., and the stove should be so proportioned that the mean velocity of air in the pipes is not over 50 feet per second; if the mean velocity is over 60 feet, the frictional losses become prohibitive. An oven for 7,000 cubic feet per minute has four rows of seven vertical cast-iron pipes each, with an inner heating surface of 2,121 square feet, and an additional indirect heating surface of webs and partitions of 1,428 square feet. Counting the webs and partitions as half as effective as the surface of the pipe walls, the effective wall surface may be expressed as 2,835 square feet, or 1 square foot for each 2.5 cubic feet of air heated per minute to 300°. Friction losses in such an oven will be 3 to 8 per cent., at pressures of 24 to 48 ounces per square inch; they average 4 per cent. The total grate surface is 42 square feet; free air area between grate bars 16 square feet. Chimney 70 feet high, 36 inches inside diameter.

J. W. RICHARDS.

**The Porteous Portable Tilting Furnace.** *Metal Ind.*, October, 1904.—Comparative tests of melting 5,400 pounds of brass in ordinary crucibles and in the Porteous furnace show as follows:

| Crucibles. | | Porteous furnace. | |
|---|---|---|---|
| Coke | $5.00 | Oil | $4.50 |
| Crucibles | 5.00 | Labor | 1.00 |
| Labor | 8.00 | Loss of metal, 1¼ per cent. | 8.44 |
| Loss of metal, 5 per cent. | 33.75 | | |
| | $51.75 | | $13.94 |

J. W. RICHARDS.

**Casting of Large Bronze Tablets.** *Metal Ind.*, November, 1904.—Description of the casting of four tablets for the Williamsburg Bridge over the East River, New York, each being 52 feet 7 inches long, 4 feet 3 inches wide, only three-eighths inch thick and weighing each nearly three tons. The molds were in sections, each section being 25 feet long, 5 feet wide and 1 ft. thick, and 125 risers being provided to allow air to escape. Pouring was done simultaneously at seven gates. The metal was made in crucibles, remelted in a cupola, and poured very hot in order to be thin enough to fill the mold.

J. W. RICHARDS.

**Copper Mines of Lake Superior, X, XI.** BY T. A. RICKARD. *Eng. Min. J.*, December 15 and 22, 1904.—The first article contains very complete details respecting the stamping and concentration treatment of the native copper ore. Details of the construction and use of the huge steam stamps, one of which has a record of 779 tons of rock crushed per day, make very interesting reading. The Calumet and Hecla plant, with its 28 steam stamps, can crush 8,000 tons per day. Compound engines are used on the

most modern steam stamps. About one-quarter of all the copper in the rock is obtained as crushed lump copper directly from the stamp mortar, by a heavy current of water which enters the mortar at such velocity that rock is unable to drop through it, but heavy lumps of copper can. On rock containing one per cent. copper, the total extraction is 82 per cent., leaving about 0.3 per cent. in the tailings. The stamp reduces the material only to an average size of $\frac{3}{8}$ inch, and several companies are taking steps to supplement this with finer grindings, in order to extract a higher percentage of copper.

The second article deals at length with the smelting of the concentrate. The concentrate, with some black copper, averaging 70 to 80 per cent. copper is charged (18 tons) into a reverberating furnace with 2 to 3 tons of return (poling) slag, and 1.25 tons of limestone. Five tons of soft coal are used. The slag first formed carrying 12 to 18 per cent. copper is sent to a cupola for further reduction; the poling slag, carrying 25 to 30 per cent. copper, goes back into the next charge; the other product is refined copper. The cupola charge consists of 20 tons of slag, 0.8 to 0.9 ton of limestone and 6 tons of hard coal; the products are: black copper, which goes back to the reverberatory furnace charge, and slag, which after passing through a settler goes to the dump, as it carries but 0.75 per cent. of copper. Each reverberatory furnace has a hearth 10 by 16 feet, and can treat 400 tons of concentrate per week, not including the lump copper and black copper from the cupola. Sometimes the refined copper is cast into anodes for subsequent electrolytic refining. The refined copper has a conductivity of 99 on Matthiessen's scale, the electrolytic copper 103. The new plant of the Michigan Smelting Co., built in 1904, has reverberations with hearths 18 by 50 feet, capable of treating 100 to 150 tons of concentrate daily. The copper is run melted into separate furnaces for refining, having hearths 14 by 23 feet. All slags are run down in a cupola, the black copper being returned to the reverberatories, and the slag granulated and run into the lake.

J. W. RICHARDS.

**The Copper River Country, Alaska.** BY W. R. ABERCROMBIE. *J. Franklin Inst.*, October and November, 1904.—An interesting account of explorations during the last fifteen years. The country is now opened up to prospectors, and the region about Mt. Wrangell promises to become an important silver and copper mining center. In 1899, a very large deposit of bornite, carrying 85 per cent. of copper was found. In a circle 80 miles in diameter, the whole country is mineralized to such an extent as to far surpass the copper deposits of Montana.

J. W. RICHARDS.

**Smelters and Smelting Practice in British Columbia.** By W. M. Brewer. *Eng. Mag.*, December, 1904.—An interesting, well-illustrated article. There is described a movable bridge, used in the roasting yard of the Tyce Copper Co., Ltd., at Ladysmith, Vancouver Island, which is a bridge on rails spanning the roast heaps between the trestles on which the ore cars run. The latter are turned at right angles, run on the bridge and dumped directly on the heap. The ore needs no spreading by hand, afterwards, and has made a considerable saving in making up the heaps. J. W. Richards.

**The Granby Copper Mine.** By D. E. Woodbridge. *Iron Age*, December 1, 1904.—An illustrated description of the mining and smelting of very low-grade copper ore, and bessemerizing matte. The plant treats 4,000 tons of ore daily.

J. W. Richards.

**A New Process for Treating Silver Sulphide and Gold Ore.** By M. Vaygoung. *Eng. Min. J.*, December 29, 1904.—Experiments were made on Tonopah ore, using a solution of 1 to 2 per cent. ferric chloride, 15 to 20 per cent. common salt, and a little free hydrochloric acid, the whole charged with chlorine. It was found: (1) That 95 to 97 per cent. of the silver was dissolved, either by boiling two or three hours or by allowing to stand in the cold, with occasional stirring, two or three days; in the cold, in three or four days almost all the silver can be extracted, whether it is present as chloride, sulphide or native. (2) The silver can be constantly removed by gentle electrolysis, as it is taken up by the solution. (3) Gold is also extracted by the dissolved chlorine. (4) Sulphuric acid may be used instead of hydrochloric, for acidifying the solution. In practice, the solution is electrolyzed as it leaches out of one vat, the electrolysis removing gold and silver and charging it freshly with chlorine, so that it is at once ready to run into another vat. The only loss is the acid necessary for furnishing the chlorine lost. The solution must be electrolyzed at rest, using a current density of 10 amperes per square meter, at a voltage of 1.5 to 2.0 volts. The deposit is slimy or spongy, and is washed off, if the solution is not at rest. These conditions are reversed, if a little glue is added to the solution, when by using the proper current density good, adherent deposits are obtained from hot or cold solutions, either at rest or in violent agitation. Carbon or graphite made the best electrodes. J. W. Richards.

**The New Chlorination.** By W. E. Greenawalt. *Eng. Min. J.*, December 1, 1904.—The Cripple Creek sulphotelluride ore can be chlorinated by crushing to 12 or 16 mesh, roasting and chloridizing; if it is to be cyanided, it must be crushed to 24 or 30 mesh and roasted. The extra cost of the fine crushing for

cyaniding more than compensates for the saving in chemicals, so that the chlorination, especially if chlorine is electrically generated, is the cheaper of the two processes. The cost of chemicals (bleach and acid) is 75 to 80 cents per ton of ore, but if the chlorine is generated electrolytically on the spot, the cost may be less than 20 cents, and even as low as 10 cents. In other words, 15 pounds of bleaching-powder and 30 pounds of sulphuric acid, costing 75 cents, are replaced by the use of 9 pounds of salt costing 4.5 cents, 12.5 horse-power hours of electric power, costing 6.5 cents and general expenses 4 cents, a total cost for chemicals of 15 cents per ton. The caustic soda produced by the electrolytic process would also have a value nearly equal to the cost of producing the chlorine, so that by making and selling caustic soda, the chlorine would practically cost nothing. J. W. RICHARDS.

**Chlorination vs. Cyanidation.** BY P. ARGALL. *Eng. Min. J.*, December 29, 1904.—This paper contradicts many of the assertions of Mr. Greenawalt (see preceding abstract). It is stated that ore can be crushed for cyaniding to 200 mesh without screening, at a cost of 43 cents per ton, which is less than the cost of roasting (55 cents) preliminary to chlorination. The cost of cyaniding this fine material, with filter-press separation of the solution, is 40 cents per ton, making the total cost 83.5 cents per ton. Mr. Argall believes that the *tailings* from an ordinary chlorination process could be treated by the cyanide process at a fair profit. J. W. RICHARDS.

## ORGANIC CHEMISTRY.

**Primary Arsines.** BY WILLIAM M. DEHN. *Am. Chem. J.*, 33, 101-153.—The introduction is devoted to an exhaustive and critical comparison of the amines, phosphines, arsines, stibines, and bismuthines, in physical and chemical properties. The differences in the behavior of these closely related groups of compounds are clearly set forth, particularly the comparison of the arsine reactions with those of the other groups. EXPERIMENTAL.—Methyl arsine may be formed by reducing methyl arsine chloride, $CH_3AsCl_2$, with zinc and hydrochloric acid. The best results were obtained with zinc dust amalgamated by treatment with mercuric chloride solution. Tables are given showing the ratio of hydrogen and arsine evolved when $MgC_2H_5AsO_3$ was treated with alcohol, hydrochloric acid and zinc dust (amalgamated and unamalgamated), the arsine being determined with silver nitrate solution. The electrolytic reduction of cacodyl chloride results in the formation of nascent cacodyl groups, which either combine directly to form cacodyl, or unite with the nascent hydrogen to form the arsine: $2(CH_3)_2AsCl + H_2 = (CH_3)_2As—As(CH_3)_2 + 2HCl$, and $2(CH_3)_2AsCl + 2H_2 = 2(CH_3)_2AsH + 2HCl$. There is

considerable evidence also that in the reduction of monoalkylated arsenic compounds to primary arsines, analogous intermediate products are formed. *Monomethyl arsine* is most conveniently prepared by reducing methyl arsonic acid with amalgamated zinc dust, alcohol and hydrochloric acid, and is liquefied by means of solid carbon dioxide. It is a colorless, transparent, mobile liquid, b. p. 2° at 755 mm., 17° at 1.5 atmospheres, highly refractive, soluble in alcohol, ether or carbon disulphide in all proportions, and has a peculiar very disagreeable odor, somewhat like cacodyl. On inhalation, it immediately produces the symptoms of arsenical poisoning. A rat placed in a bottle, and caused to breathe the vapors from one drop of the arsine, died almost immediately. One million parts of water dissolve 85 parts of the arsine. When gaseous methyl arsine is treated over mercury with dry oxygen, methyl arsine oxide (m. p. 95°) is first formed, and then methyl arsonic acid: $CH_3AsH_2 + O_2 = CH_3AsO + H_2O$, and $2CH_3AsH_2 + 3O_2 = 2CH_3AsO(OH)_2$. In one experiment a mild explosion occurred, probably due to the following reaction taking place: $2CH_3AsH_2 + O_2 = 2As + C_2H_6 + 2H_2O$. Oxidized with concentrated nitric acid, methyl arsonic acid, arsenic acid, and formic acid are produced; while, with a neutral or alkaline solution of silver nitrate, silver is precipitated and methyl arsonic acid formed. Methyl arsine, passed into an absolute alcohol solution of iodine, gave the di-iodide, $CH_3AsI_2$, and a brown amorphous mass when the arsine was in excess. With standard solution of iodine in potassium iodide, the reaction proceeds quantitatively, as follows: $CH_3AsH_2 + 6I + 3H_2O = CH_3AsO(OH)_2 + 6HI$. With a carbon disulphide solution of bromine, the reaction was apparently: $CH_3AsH_2 + 6Br = AsBr_3 + 2HBr + CH_3Br$. With dry hydrochloric acid, little if any chloride was formed. With dry hydrogen sulphide, the formation of sulphide, $CH_3AsS$, if it occurred at all, was only partial. Arsonium compounds are best prepared by heating the arsine at 100°-150°, with excess of alkyl halide in sealed tubes filled with carbon dioxide. *Tetramethyl arsonium iodide* was thus obtained from methyl arsine and excess of methyl iodide: $CH_3AsH_2 + 3CH_3I = (CH_3)_4AsI + 2HI$. *Methyl triethyl arsonium iodide*, from methyl arsine and ethyl iodide, forms white crystals. *Magnesium ethyl arsonate* may be conveniently prepared by treating potassium arsenite in dilute alcoholic solution with ethyl iodide, and converting the resulting potassium ethyl arsonate into the magnesium salt: $C_2H_5I + K_3AsO_3 = C_2H_5K_2AsO_3 + KI$. The magnesium salt separates from aqueous solution in white spherical aggregates, containing a variable amount of water of crystallization. It is readily soluble in acids, but insoluble in alkalies; 1000 parts water at 22° dissolve 2.31 parts. *Ethyl arsine disulphide*, $C_2H_5AsS_2$, was obtained on passing hydrogen sulphide through a hydrochloric acid solution of magnesium ethylarsonate. It is a viscid light-yellow oil,

of bad odor, specific gravity 1.836 at 24°, insoluble in water, alcohol or ether, easily soluble in benzene, chloroform, carbon disulphide, alkalies or alkaline sulphides. It is easily dissolved by dilute nitric acid, with formation of ethyl arsonic acid. Methyl arsine disulphide, when heated, decomposes into trimethyl arsine sulphide and arsenic pentasulphide. Trimethyl arsine sulphide crystallizes in glistening white needles, m. p. 174°. *Triethyl arsine sulphide*, $(C_2H_5)_3AsS$, sublimes when ethyl arsine disulphide is heated to 195°. It crystallizes from carbon disulphide in white needles, m. p. 119.5°, and has a disagreeable odor. With concentrated hydrobromic acid it reacts as follows: $(C_2H_5)_3AsS + 2HBr = (C_2H_5)_3AsBr_2 + H_2S$. *Magnesium methyl arsonate* may be prepared by the method given above for the ethyl compound. It forms small white crystals; 1000 parts of water at 22° dissolve 2.118 parts, at 99° 3.085 parts. *Magnesium phenyl arsonate* is precipitated when a solution of phenyl arsonic acid is boiled with magnesia mixture. *Silver phenyl arsonate* is a pure white, glistening, micro-crystalline solid, darkening in the light. As methyl, ethyl and phenyl arsonic acids are precipitated by magnesia mixture only on boiling, a method is available for separating organic from inorganic arsenic acids. *G. Meyer's Reaction.*—In the preparation of arsonic acids by heating together alkaline arsenites with alkyl halides in dilute alcoholic solution, some ether (about 30 per cent.) is also formed by the action of the alcoholic alkali, always present in the mixture, upon the halide: $RX + M_3AsO_3 = RM_2AsO_3 + MX$, and $ROM + RX = ROR + MX$. The best yields of arsonic acids were obtained with potassium arsenite and iodides. The reaction appears to be quite general in its scope. *Ethyl arsine*, $C_2H_5AsH_2$, was prepared, in quantitative yield, by the reduction of magnesium ethyl arsonate. It resembles methyl arsine in physical and chemical properties; b. p. 36°, specific gravity at 22°, 1.217; 1,000,000 parts of water at 19° dissolve 126 parts. Its slow oxidation products with air are light-yellow, while those from methyl arsine are bright red. With dry air, ethyl arsine yielded mainly the oxide, $C_2H_5AsO$; with concentrated nitric acid, arsenic acid and ethyl arsonic acid were formed, while with silver nitrate, the arsonic acid was the main product. With concentrated sulphuric acid, white, compact crystals were obtained, probably $(C_2H_5AsH_2)_2H_2SO_4$. *Tetraethyl arsonium iodide*, $(C_2H_5)_4AsI$, forms pure white crystals. *Ethyl trimethyl arsonium iodide* crystallizes from alcohol in hard, glistening needles, not melting at 300°, soluble in water, chloroform or hot alcohol, insoluble in ether. *Ethyl triisoamyl arsonium iodide* forms compact crystals, not melting at 250°. When ethyl arsine was heated at 120° with carbon disulphide and absolute alcohol, triethyl arsine sulphide was formed. *Phenyl arsine*, $C_6H_5AsH_2$, prepared by reducing calcium phenyl arsonate, is a transparent, highly refractive, heavy oil, b. p. 148°, 93° at 70 mm.,

$84^\circ$ at 55 mm., $77^\circ$ at 33 mm., insoluble in water, readily soluble in alcohol, ether or carbon disulphide. In the air it rapidly oxidizes to phenyl arsine oxide, phenyl arsonic acid, and arsenobenzene, $C_6H_5As:AsC_6H_5$. Concentrated nitric acid attacks it violently, forming phenyl arsonic acid, arsenobenzene, nitrobenzene and arsenic acid. Excess of bromine acts upon an ether solution of phenyl arsine as follows: $C_6H_5AsH_2 + Br_2 = C_6H_5As HBr.HBr; + Br_2 = C_6H_5AsBr_2.HBr; + Br_2 = C_6H_5Br + AsBr_3$. With a solution of iodine in aqueous potassium iodide, the reactions are as follows: $C_6H_5AsH_2 + 6I + 3H_2O = C_6H_5AsO(OH)_2 + 6HI$, and $C_6H_5AsH_2 + 4I = C_6H_5AsI_2 + 2HI$. *Phenyl triisoamyl arsonium iodide*, pearly white crystals, m. p. $163^\circ$.

M. T. BOGERT.

**The Reaction between Unsaturated Compounds and Organic Magnesium Compounds. IV. Reactions with Esters of α-Phenylcinnamic Acid.** BY E. P. KOHLER AND GERTRUDE HERITAGE. *Am. Chem. J.*, 33, 153–164.—Methyl phenylcinnamate is the first of the unsaturated esters so far studied to give perfectly clean reactions with organic magnesium derivatives. With aryl magnesium halides the reaction consists exclusively in a 1,4-addition of the magnesium compound to the unsaturated ester, and the products are crystalline. The reaction can be used for the preparation of certain types of unsaturated acids, as, for example, triphenylacrylic: $C_6H_5CH:C(C_6H_5)COOCH_3 + C_6H_5MgBr = (C_6H_5)_2CHC(C_6H_5):C(OCH_3)OMgBr; + Br_2 = (C_6H_5)_2CHC(C_6H_5)Br.COOCH_3 + MgBr_2$, which $+ 2KOH = (C_6H_5)_2C:C(C_6H_5)COOK + KBr + CH_3OH + H_2O$. The yield is good, and it is not necessary to purify the intermediate products. With methylmagnesium iodide, phenylcinnamic ester gives a tertiary alcohol, like all other unsaturated esters so far studied. EXPERIMENTAL.—*Reaction with Phenylmagnesium Bromide*, $(C_6H_5)_2CHC(C_6H_5):C(OCH_3)OMgBr$, separates when an ether solution of phenylcinnamic methyl ester is added to a boiling ether solution of phenylmagnesium bromide. It crystallizes in small lustrous prisms, and rapidly absorbs dry hydrochloric acid gas, with formation of methyl triphenylpropionate. It reacts readily with acid chlorides, but not with methyl iodide; with acetyl chloride the product is $(C_6H_5)_2CHC(C_6H_5):C(OCH_3)OCOCH_3$, which crystallizes from alcohol in plates, m. p. $75^\circ$, and is easily hydrolyzed. With bromine, it gives triphenylbrompropionic ester. *Methyl triphenylpropionate*, $(C_6H_5)_2CHCH(C_6H_5)COOCH_3$, is also formed when the above magnesium compound is allowed to stand in the air. It crystallizes in hard, lustrous plates, m. p. $159^\circ$, readily soluble in chloroform, or in boiling acetone, moderately so in boiling alcohol or in ether. No ketone or tertiary alcohol could be obtained by boiling its ether solution with phenylmagnesium bromide, probably because of the interference of the α-phenyl group. *Triphenylpropionic acid*

crystallizes in needles, m. p. 211°, readily soluble in alcohol or ether, insoluble in water. *Ethyl triphenylpropionate* crystallizes in plates, m. p. 120°. *Triphenylbrompropionic ester*, $(C_6H_5)_2CHCBr(C_6H_5)COOCH_3$, obtained as mentioned above, crystallizes in large colorless prisms, melting with decomposition at 150°-152°, and on boiling with alcoholic potash gives triphenylacrylic acid, $(C_6H_5)_2C:C(C_6H_5)COOH$ (m. p. 213°). *Reactions with o-Tolylmagnesium Bromide.—Methyl tolyldiphenylpropionate*, $C_7H_7(C_6H_5)CHCH(C_6H_5)COOCH_3$, crystallizes from a mixture of alcohol and acetone in hard lustrous plates, m. p. 150°. *o-Tolyldiphenylpropionic acid* crystallizes from dilute alcohol, in long needles, m. p. 190°. *Reaction with α-Naphthylmagnesium Bromide.—Methyl α-Naphthyldiphenylpropionate.*—When the reaction-product from α-naphthylmagnesium bromide and phenylcinnamic methyl ester was decomposed with iced hydrochloric acid there were obtained, in addition to some dinaphthyl, and a small amount of naphthalene, two forms of the methyl ester of α-naphthyldiphenylpropionic acid. One of these crystallizes in small lustrous pyramids or prisms, m. p. 170°. The other crystallizes in large, lustrous prisms, m. p. 128°, and is much more soluble in organic solvents than its isomer. The two esters may be stereomers, although they give the same acid on hydrolysis. *a-Naphthyldiphenylpropionic acid* crystallizes from dilute alcohol in short, thick needles, m. p. 171°. On esterifying the acid with methyl alcohol, the lower melting ester was obtained. *Reaction with Methylmagnesium Iodide.—Diphenylmethyl Butenol*, $C_6H_5CH:C(C_6H_5)C(CH_3)_2OH$.—Although the α-phenyl group appears to interfere in reactions between an ester and phenylmagnesium bromide, it seems to be without effect in the case of methylmagnesium iodide, as the sole product of the reaction between this substance and methyl phenylcinnamate was the magnesium compound of the above tertiary alcohol. The alcohol crystallizes from ether in thin plates, from ligroin in long flat needles, and melts at 68°. It does not combine with bromine, and is oxidized by alkaline permanganate to benzoic and acetic acids.

M. T. BOGERT.

**On the Dissociation of Phenoquinone and Quinhydrone.** BY HENRY A. TORREY AND H. HARDENBERGH. *Am. Chem. J.*, 33, 167-179.—The fact that phenoquinone, which is red in the solid state, and quinhydrone, which is green, both dissolve to a yellow solution in organic solvents, suggested the idea that in solution they are dissociated into quinone and phenol in the one case, and into quinone and hydroquinone in the other. Molecular weight determinations in benzene showed this to be the case. EXPERIMENTAL.—Phenoquinone separates in beautiful, red crystals when phenol (two molecules) and quinone (one molecule) are brought together in ligroin solution. Quinhydrone was

similarly prepared by mixing ether solutions of quinone (one molecule) and hydroquinone (one molecule). The determinations of the molecular weight of phenoquinone showed that it was highly dissociated in benzene. That phenol and quinone are actually the products of the dissociation of phenoquinone was further shown by the fact that addition of either of these substances to saturated solutions of phenoquinone caused a separation of some of the phenoquinone. Some reassociation of phenol and quinone apparently occurs also when phenol or quinone is added to the solution. Similar experiments with quinhydrone showed that it too was highly dissociated in benzene. When quinhydrone was dissolved in warm chloroform, and the solution allowed to cool slowly, hydroquinone separated at about 35°; below 35° quinhydrone itself began to separate. From its solutions, quinhydrone may be precipitated by the addition of either of its dissociation products. That phenoquinone and quinhydrone are dissociated in other solvents is shown by the color of the solutions obtained. When phenoquinone is treated with alcohols, the phenol is dissolved first, and then the quinone.

M. T. Bogert.

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## BIOLOGICAL CHEMISTRY.

**Approximately Complete Analyses of Thirty "Normal" Urines.** By Otto Folin. *Am. J. Physiol.*, **13**, 45–66.—Folin has made approximately complete analyses of the urines of six subjects over a period of five days. The diet consisted of 500 cc. milk, 300 cc. cream, 450 grams eggs, 200 grams malted milk, 20 grams sugar, 6 grams sodium chloride, and water enough to make the whole up to 2 liters. In addition 900 cc. of water were allowed. The ingredients combined into a liquid mixture contained 119 grams proteid and approximately 148 grams of fat, and 225 grams of carbohydrates. Total nitrogen was determined by a modified form of the Kjeldahl method. Urea by Folin's method (*Ztschr. physiol. Chem.*, **32**, 504); ammonia by the Folin-Schaffer method (*Ztschr. physiol. Chem.*, **37**, 161 and *Am. J. Physiol.*, **8**, 330); creatinin by the method of Folin (*Ztschr. physiol. Chem.*, **41**, 223); uric acid by the Folin and Schaffer method (*Ztschr. physiol. Chem.*, **32**, 552); chlorides, according to Volhard; phosphates by uranium acetate; inorganic sulphates by the method of Folin (*Am. J. Physiol.*, **7**, 152); ethereal sulphates, by a modification of the usual method; total sulphur by ignition with potassium carbonate; neutral sulphur by difference; indican, by comparison with standard indigo-blue solutions; total acidity, by method of Folin (*Am. J. Physiol.*, **9**, 265); and mineral acidity, by the method of Folin (*Am. J. Physiol.*, **9**, 270). A discussion of the results obtained

is given in a later paper, by Folin (*Am. J. Physiol.*, 15, 66-116).
F. P. UNDERHILL.

**Some Notable Constituents of the Urine of the Coyote.** BY ROBERT E. SWAIN. *Am. J. Physiol.*, 13, 30-35.—Kynurenic acid, which has, heretofore, been found in the urine of the dog, appears to be a constant constituent of the urine of the American coyote — *Canis ochropus Eschscholtz.* In the urine of the one animal studied an average daily excretion of 0.139 gram of kynurenic acid was found. Allantoïn was also present, amounting to 0.056 gram per day. An analysis of the combined urine, collected over a period of ten days, is given, the more important results of which are the high specific gravity (1.048), and the amounts of urea (70.144 grams per liter), allantoïn (0.264 gram per liter), and kynurenic acid (0.422 gram per liter). In addition, there was found a crystalline substance, which may be some new constituent of carnivorous urine, though it very nearly corresponds with Jaffé's "Urocaninsäure" in composition and general properties. Its formula was calculated to be $C_{12}H_9N_4O_4.4H_2O$. A further investigation of the latter substance is promised as soon as another coyote can be obtained. F. P. UNDERHILL.

**Experimental Studies on the Physiology of Molluscs. First Paper.** BY LAFAYETTE B. MENDEL AND HAROLD C. BRADLEY. *Am. J. Physiol.*, 13, 17-30.—In *Sycotypus canaliculatus* the salivary glands and the liver or hepato-pancreas are the only organs secreting digestive enzymes. In the salivary glands a proteolytic enzyme is present, which acts normally upon proteids in the cold, and in neutral or amphoteric media. The products formed in this digestion are similar to those produced by trypsin. In the liver there are present an amylase, invertin and a lipase. The amylase is similar to the amylolytic enzyme of the vertebrate liver. Digestion takes place in the stomach proper, and in the so-called hepatic ducts. In the stomach, the proteids are broken down to proteose and peptone, and the products of digestion absorbed through the rugae. Fats and carbohydrates are largely hydrolyzed in the hepatic ducts, where also the products of their hydrolysis are absorbed and retained. F. P. UNDERHILL.

**The Reversal of Ciliary Movement in Metazoans.** By G. H. PARKER. *Am. J. Physiol.*, 13, 1-17.—When in contact with carmine, India ink, sand, pellets of filter-paper, moistened with sea-water, or with solutions of sugar, quinine, or picric acid in sea-water, the labial cilia of *Metridium maraginatum* do not show a reversal of movement. The reversal does not take place when the cilia are in contact with crab meat from which most of the extractives have been taken, but the cilia show reversal of movement to dilute crab-meat juice, and slightly to a sea-water extract of rubber. The reversal due to crab-meat juice is probably de-

pendent upon some organic combination containing potassium. It is shown that the reversal is due to potassium ions, for it occurs in $\frac{5}{8}$ M sodium chloride $+\frac{1}{3}$ M potassium nitrate, but not in $\frac{5}{8}$ M sodium chloride $+\frac{1}{3}$ M sodium nitrate. F. P. UNDERHILL.

**The Chemistry of the Protein Bodies of the Wheat Kernel. Part I. The Protein Soluble in Alcohol and Its Glutaminic Acid Content.** BY THOMAS B. OSBORNE AND ISAAC F. HARRIS. *Am. J. Physiol.*, 13, 35–45.—The authors show that Kutscher's (*Ztschr. physiol. Chem.*, 38, 111) determinations of glutaminic acid, 19.81 per cent., fall far short of the actual quantity, 34.2 to 37.33 per cent. of this substance yielded by the alcohol-soluble protein of wheat, and that they, therefore, afford no evidence which justifies the conclusion that this substance consists of two distinct protein bodies. From investigations on the glutaminic acid content of fractional precipitations of the alcohol-soluble protein, and the close agreement of these precipitations with respect to composition and properties, the authors maintain that only one protein is present, for which the name gliadin should be retained. Gliadin yields a proportion of glutaminic acid much in excess of that obtained from any other known protein, and greater than that of any single decomposition product yet obtained in a pure state from any other true protein substance, the protamines excepted. The view is advanced that this large proportion of glutaminic acid in a food protein so extensively used is a matter of importance in relation to the food value of this substance. F. P. UNDERHILL.

**Insects: the Rôle They Play in the Transmission of Disease.** BY HENRY ALBERT. *N. Y. and Phila. Med. J.*, 81, 220–225.—The author states that among the diseases transmitted directly by insects are malaria, yellow-fever, elephantiasis, trypanosomiasis, sleeping fever, relapsing fever, Texas fever of cattle, Typhoid fever, tuberculosis, plague, cholera (Asiatic), yaws, leprosy, anthrax, worms, and purulent conjunctivitis.

F. P. UNDERHILL.

**Further Experiments on the Production and Inhibition of Glycosuria in Rabbits by Salts.** BY MARTIN H. FISCHER. *Pflüger's Arch.*, 106, 80–84.—Fischer shows that the glycosuria produced by salts (sodium chloride) (*Univ. Cal. Pub. Physiol.*, 1, 77 and 87, also this Review 26, 258) is probably caused by the action of the latter upon the diabetic center in the spinal bulb. Lithium and potassium chlorides have a similar influence, but ammonium chloride is without effect. Strontium chloride also possesses the power to call forth a severe glycosuria. In the present experiments, the salts were injected into the *arteria axillaris* of the rabbit. F. P. UNDERHILL.

**Formation of Acids by Enzymes.** By J. E. Hinkins. *Am. Chem. J.*, 33, 164-167.—Solutions of triacetyl glucose, when subjected to the action of ptyalin and pancreatin, gradually develop an acid reaction, due probably to the formation of organic acids. The acidity is increased by the simultaneous presence of bacteria. Such acid solutions readily dissolve cements employed for tooth fillings. The abnormal increase in the acidity of the saliva of persons suffering from tooth erosion is probably due to the re-solution of certain constituents of the saliva.

F. P. Underhill.

**Laws Governing the Chemical Composition of Urine.** By Otto Folin. *Am. J. Physiol.*, 13, 66-116.—From a study of thirty normal urines (*Am. J. Physiol.*, 13, 45-66) excreted by subjects living on a fixed diet, representing the usual standards of diet, and also from a study of urines obtained from diets which were as different from the ordinary standards of diet as they could be made, Folin has deduced several laws relating to the chemical composition of human urine. He finds that the distribution of the nitrogen in urine among urea and other nitrogenous constituents depends on the absolute amount of total nitrogen present. As an illustration, one subject on a protein-rich diet eliminated urea representing 86.3-89.4 per cent. of the total nitrogen; while a subject on a low-proteid diet excreted urea representing only 62-80 per cent. of the total nitrogen. The distribution of the sulphur in urine among the three chief normal representatives—inorganic sulphates, ethereal sulphates, and "neutral sulphur"—depends on the absolute amount of total sulphur present, for with a reduction of the total nitrogen and total sulphur in the urine, there is a smaller per cent. represented as urea and as inorganic sulphates, and a relative increase in the other representatives of these two elements. The absolute quantity of kreatinin eliminated in the urine on a meat-free diet is a constant quantity differing for different individuals, but wholly independent of quantitative changes in the total amount of nitrogen eliminated. One subject eliminated urines containing 15.8 grams and 2.7 grams total nitrogen on two different days, and yet the amount of kreatinin excreted was exactly the same on the two days. When the total amount of protein-metabolism is greatly reduced, the absolute quantity of uric acid is diminished, but not nearly in proportion to the diminution in the total nitrogen, and the per cent. of the uric acid nitrogen in terms of the total nitrogen is, therefore, much increased. With pronounced diminution in the protein-metabolism there is usually a decrease in the absolute quantity of ammonia eliminated. A pronounced reduction of the total nitrogen is always accompanied by a relative increase in the ammonia-nitrogen, provided the food is not such as to yield an alkaline ash. Urea is the only nitrogenous substance

which suffers a relative as well as an absolute diminution with a diminution in the total protein-metabolism. Urinary indican is not to any extent a product of the general protein-metabolism. It is, therefore, probably a product of intestinal putrefaction, and may consequently be taken to indicate approximately the degree of putrefaction in the intestinal tract. The ethereal sulphates can only in part be due to intestinal putrefaction, and neither their absolute nor relative amount can be accepted as an index of the extent to which putrefaction is taking place in the intestine. The ethereal sulphates represent a form of sulphur metabolism, which becomes more prominent when the food contains little or no protein. The neutral sulphur is not at all due to processes identical or similar to those which give rise to indican. The neutral sulphur represents products which, in the main, are independent of the total amount of sulphur eliminated or of protein catabolized. The volume of water eliminated by the kidney depends directly upon the amount of water consumed. If the chlorine intake is constant, the chlorine elimination varies chiefly with the volume of the urine. From a study of the relation of phosphates and organic acids to the acidity of urine it was found that the phosphates in clear acid urine are all of the monobasic kind, and the acidity of such urines is ordinarily greater than the acidity of all the phosphates, the excess being due to free organic acids. F. P. UNDERHILL.

**A Contribution to Cell-Chemistry.** BY VICTOR C. VAUGHAN. *Am. J. Physiol.*, 13, XI–XII.—Mature bacteria subjected to the action of sodium alcoholate are split into two portions, one of which, constituting about one-third of the cell substance, may be transformed by platinum chloride into a body possessing the properties of a toxin. The other portion may be divided into several divisions, all of which possess hemolytic, but not antitoxic, properties. F. P. UNDERHILL.

**The Hydrolytic Cleavage of Protoalbumose.** BY P. A. LEVENE. *Am. J. Physiol.*, 13, XII–XIII.—By the hydrolytic cleavage of protoalbumose a substance was formed which had properties peculiar to itself, and was unknown. Analysis showed that the probable formula for the substance was $C_{12}H_{22}N_4O_5$.
F. P. UNDERHILL.

**A Study of the Conditions Following the Establishment of the Eck Fistula in Dogs.** BY P. B. HAWK. *Am. J. Physiol.*, 13, XIV.—Dogs with eck fistula, when fed on mixed diet, give pronounced ataxia, entire loss of sight and hearing, complete anesthesia and catalepsy at intervals of about four days. A poor appetite and a grert loss of weight were noted. The animals lived from 59-70 days Autopsy in one case showed a large quantity of ascitic fluid and tubercular nodules in omentum, mesentery

and liver. Injections of sodium carbonate were without effect.
F. P. UNDERHILL.

**On Jensen's Theory of Geotropism in Paramoecium.** BY E. P. LYON. *Am. J. Physiol.*, 13, XV.—Tends to prove that Jensen's (*Arch. f. d. Gesammte Physiol.*, 43, 428) theory of geotropism of paramoecuim is incorrect. F. P. UNDERHILL.

**On Para-lactic Acid.** BY ARTHUR R. MANDEL. *Am. J. Physiol.*, 13, XVI.—When a dog is poisoned with phosphorus, lactic acid is produced in the urine. It is possible that the lactic acid may be derived from the proteid carbohydrate molecule as a cleavage product. If this were true, no lactic acid should be formed in diabetes, even though phosphorus poisoning be present. Experimentally, this has been found to be the case, for when a dog has been poisoned with phosphorus the urine contained lactic acid, but when phlorhidzin diabetes was induced, it disappeared. It seems probable then that the lactic acid in phosphorus-poisoning is derived from the cleavage of sugar. Preliminary experiments after ingesting fermentation lactic acid in diabetes apparently show a slight reduction of proteid metabolism, and, therefore, of sugar output, and also indicate the synthesis of a small quantity of lactic acid into sugar.
F. P. UNDERHILL.

**A Method for the Quantitative Estimation of Carbamates in Animal Fluids.** BY J. J. R. MACLEOD AND H. D. HASKINS. *Am. J. Physiol.*, 13, XVII. See *Am. J. Physiol.*, 12, 444; also this Review for abstract. F. P. UNDERHILL.

**Some Remarks on the Chemistry of Carbamates.** BY J. J. R. MACLEOD AND H. D. HASKINS. *Am. J. Physiol.*, 13, XVII.-XIX.—When ammonia water is added to sodium carbonate or bicarbonate no carbamate is formed unless there is a large excess of ammonia present. By mixing solutions of ammonium chloride and sodium carbonate in various proportions large amounts of carbamate are invariably formed. Preformed ammonium hydroxide in contact with sodium carbonate does not therefore cause the formation of carbamates, whereas, ammonia in the free state readily forms it. These facts are in opposition to Drechsel's conclusion, that carbamate can result without the ammonia being in a free state. In the oxidation at body-temperature of glycocoll, aspartic and tartaric acids with ammonium permanganate in the presence of 2.5 per cent. ammonia water (0.7 per cent. ammonia), a very large amount of carbamate is found, especially in the early stages of the process.
F. P. UNDERHILL.

**On the Origin of Kreatinin.** BY WALDEMAR KOCH. *Am. J. Physiol.*, 13, XIX.—The view is advanced that the kreatinine

of the urine has its origin in two sources, namely, lecithin and proteid. From the lecithin the methyl group is obtained, and the proteid supplies most or all the nitrogen of the kreatinine.

F. P. UNDERHILL.

**On the Elimination of Creatinine.** BY LAFAYETTE B. MENDEL AND OLIVER E. CLOSSON. *Am. J. Physiol.*, 13, XIX.—In this article the authors have determined the total creatinine output in a considerable number of individuals under varying conditions of diet, in health and disease. Attention is directed to the noteworthy excretion of creatinine in vegetarians (denied by Caspari and Glaessuer) as well as in individuals living on a low proteid diet for long periods, and to the rate of excretion during brief periods, in comparison with the simultaneous total nitrogen and uric acid output. In general, on a creatin-free diet, there is a tendency towards parallelism between the total nitrogen output and the eliminaton of the creatinine group.

F. P. UNDERHILL.

**On the Presence of Soaps in the Organism in Certain Pathological Conditions** (A Preliminary Communication). BY OSKAR KLOTZ. *Am. J. Physiol.*, 13, XXI.—In the production of an experimental calcareous degeneration in the kidneys of rabbits, it is shown by means of staining, that the fatty changes taking place in the cells of the tubules is in the same location as the calcareous deposit, and further, that in these kidneys, by means of proper reagents, soaps with potassium, sodium, and presumably ammonium bases can be detected. Such soaps and albumins form a combination which is insoluble in water or salt solution.

F. P. UNDERHILL.

**Observations on the Alimentary Canal after Splanchnic and Vagus Section.** BY W. B. CANNON. *Am. J. Physiol.*, 13, XXII. —After vagus section there is prolonged stasis of food in the thoracic esophagus, but after the food reaches the stomach there is an almost normal advance. Segmentation and peristalsis were noted after vagus or splanchnic section. The difference in the rate of discharge of carbohydrates and proteids was also preserved in both conditions, but the discharge of both foodstuffs from the stomach was slower than normal when the vagi were cut. There was also a slight delay in the passage of food through the small intestine. The experiments were carried out by means of X-ray observations on the movements of food mixed with bismuth subnitrate. F. P. UNDERHILL.

**Some of the Physical Phenomena of Muscle-Fatigue.** BY FREDERIC S. LEE. *Am. J. Physiol.*, 13, XXVIII-XXIX.—The authors believe that Lohmann's conclusion that there is no

physiological difference, in matter of fatigue, between cold-blooded and warm-blooded muscle, does not seem justified.

F. P. UNDERHILL.

**Gelatine as a Substitute for Proteid in the Food.** BY J. R. MURLIN. *Am. J. Physiol.*, 13, XXIX-XXX.—Experiments on dogs and man show that it is a matter of indifference how much of the proteid-nitrogen is replaced by gelatin-nitrogen, up to one-half of the starvation-requirement. F. P. UNDERHILL.

**The Effects of Isotonic Solutions on the Kidney.** BY TORALD SOLLMANN, *Am. J. Physiol.*, 13, XXX.—Perfusion of excised kidneys with various solutions of the same freezing-point, as one per cent. sodium chloride, produces the following effects: Non-electrolytes. Cane-sugar causes very slight changes; glucose produces very little effect; alcohol and urea cause marked diminution of the vein and ureter flow, and of the volume of the kidney. The effect is that of hypo-isotonic solutions. These substances penetrate the cells. Cations : Potassium and ammonium produce little change; magnesium increases the vein and ureter flow; barium, calcium and hydrogen diminish the vein and ureter flow, and the volume. Anions: The sulphate, and especially the citrate, increase the vein and ureter flow and the volume. The hydroxide, carbonate, and bicarbonate diminish them. These effects are probably osmotic actions, solutions of the same freezing-points being anisotonic to the kidney-cells, on account of differences in permeability. F. P. UNDERHILL.

**The Effect of Blood on the Blood-vessels of the Kidney.** BY TORALD SOLLMANN., *Am. J. Physiol.*, 13, XXXI.—When recently excised kidneys are perfused with defibrinated blood there is a considerable increase of vein flow; at the same time, the ureter flow and renal volume are diminished. This dilator effect is destroyed by heating the blood to the coagulation point.

F. P. UNDERHILL.

**Further Studies on Ricin.** BY THOMAS B. OSBORNE AND LAFAYETTE B. MENDEL. *Am. J. Physiol.*, 13, XXXII.—By fractional precipitation with neutral salts the castor bean proteids have separated into portions containing ricin in very pure form. The toxic preparations alone possess the power of sedimenting the colored corpuscles of mammalian blood; this property is not lost until the proteid solutions are heated to the point of coagulation. Pure ricin preparations suffer no deterioration in their physiological action after being kept for many months. Doses many times larger than the fatal dose are followed by a "latent period" of at least fifteen hours before toxic symptoms manifest themselves. The toxicity of the pure ricin is greatly diminished, when it is administered per os instead of subcutaneously.

F. P. UNDERHILL.

**On the Rate of Absorption from Intra-Muscular Tissue.** BY S. J. MELTZER AND JOHN AUER. *Am. J. Physiol.*, 13, XXXII-XXXIII.—The rate of absorption from intramuscular injections of adrenaline, curare, morphine and fluorescein in the rabbit are much more rapid and effective than subcutaneous injections of the same substances. F. P. UNDERHILL.

**A Study of the Coloring-matters in the Purple Pitcher Plant** (*Sarracenia Purpurea*). BY GUSTAVE M. MEYER AND WILLIAM J. GIES. *Am. J. Physiol.*, 13, XXXIII.—Alcohol extracts three pigments from the pitcher plant (1) chlorophyl (green), alkaverdin (purplish red), and a brownish-black material. Alkaverdin may be used as an indicator for dilute aqueous solutions. On addition of a drop of N/5 alkali, it becomes green, and is rendered colorless on being made acid. It has been obtained only in the form of a syrup, which has effect upon the spectrum. F. P. UNDERHILL.

**A Further Study of Protagon.** BY E. R. POSNER AND WILLIAM J. GIES. *Am. J. Physiol.*, 13, XXXV.—The results of Lesem and Gies indicating that protagon is a mixture of substances, are confirmed in the present article. F. P. UNDERHILL.

**Certain Aspects of Experimental Diabetes.** BY FRANK P. UNDERHILL. *Am. J. Physiol.*, 13, XXXVI.—The diabetes produced by such experimental methods as the painting of drugs like piperidine, etc., upon the pancreas of dogs is shown by the author to be due to the fact that the substances thus painted upon the pancreas or other organs, all have the same general effect upon the organism. All produce dyspnoea, and this calls forth the hyperglycemia and glycosuria. When dyspnoea is prevented, no symptoms of the experimental diabetes are manifested. F. P. UNDERHILL.

## PHARMACEUTICAL CHEMISTRY.

**Laboratory Hints.** BY H. A. B. DUNNING. *Drug Circ.*, 49, 44.—To coat pills with keratin, rub one gram of peptonized keratin to a smooth paste with 6 cc. of spirits of ammonia. Solution may be effected by applying a slight heat, and adding a little water. The pills, impaled upon needles, are immersed in this solution, which is kept hot, rotated for a few moments, and allowed to dry.

The pharmacopoeial directions for the preparation of syrup of ferrous iodide state that the solution resulting from the reaction between the iron and iodine in water should be of a greenish color. It is more generally of a brownish or yellowish color. By adding a few grams of sugar to the reaction-product before boiling, and allowing to stand for an hour or more, a syrup of a beautiful green color is always obtained. W. H. BLOME.

**Practical Coloring Agents.** By H. C. Bradford. *Merck's Rep.*, 14, 40.—The same coloring agent cannot be used to color all kinds of liquids. For fluids having an acid reaction, a tincture of cudbear, and for those having an alkaline or neutral reaction, a solution of carmine, give very permanent and satisfactory colors. Caramel gives a beautiful brown-red tint, and may be used for either acid or alkaline liquids. 30 grains of turmeric macerated for four or five days in a pint of an alcoholic liquid, gives a good yellow color. Various aniline dyes are used, but their employment is not recommended. A tincture of grass answers the requirements for a green color very well, but does not answer for ammonia. To color the latter green, add a solution of copper sulphate until the color of the ammonia solution is about the same as that of the copper solution. Then add carefully a solution of potassium bichromate until the desired shade is obtained. W. H. Blome.

**Borneo Camphor.** By Edward Kremers. *Pharm. Rev.*, 23, 7.—A very interesting description of the methods employed by the natives of Borneo in collecting and disposing of this camphor. The methods are very crude, and consist in splitting the large tree trunks and removing the crystals, which are sometimes as much as ¾ to one inch in length. The larger crystals are most highly valued, and bring as much as $40 to $50 per pound. Most of this camphor is used in religious ceremonies.

W. H. Blome.

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## SANITARY CHEMISTRY.

**The Longevity of the Typhoid Bacillus in Water.** By E. O. Jordan, H. L. Russel and F. R. Zeit. *Journal of Infectious Diseases*, 1, 641–689.—An account of the experiments of Dr. Jordan, Dr. Russel and Dr. Zeit, undertaken for the Sanitary District of Chicago, in connection with the suit brought against the District by the State of Missouri, the objects of these experiments being to determine as accurately as possible the chances of typhoid fever germs, undoubtedly present, in the sewage of Chicago, ever reaching the water supply of St. Louis, a distance *via* the Chicago Drainage Canal, Illinois and Mississippi rivers of about 370 miles. Previous experiments, made to determine the longevity of the typhoid bacillus in water, have been conducted for the most part, if not wholly, in glass vessels in the laboratory, and on account of having been carried on under such varied conditions of temperature, character of the water, and the number and age of the bacteria introduced, widely divergent conclusions had been reached by different observers. The general conclusions, however, reached from these experiments were: First, that the typhoid bacilli die out more rapidly in unsterilized

water than in the same water sterilized by heat; second, that when introduced into unsterilized water containing small amounts of organic matter, they survive longer than in a water charged with a large amount of organic matter. Laboratory experiments are so far removed from the conditions that exist in nature, that conclusions drawn from such experiments are of doubtful value, and it was thought essential, in order to form any valid conclusions regarding the chances of the typhoid bacilli in Chicago sewage surviving, so as to appear in the water supply of St. Louis, to subject them as nearly as possible to the natural conditions which exist in Lake Michigan, the Drainage Canal, and the waters of the Illinois river. To carry out the experiments under as nearly as possible the conditions that existed in these waters, pure typhoid cultures were placed in sacks made of parchment or celloidin, and these sacks suspended in the waters of Lake Michigan; in the dilute sewage of Chicago in the Chicago River; in the waters of the Sanitary Canal at Robey St., Chicago and at Lockport; and in the water of the Illinois River at Averyville, Dr. Zeit having charge of the experiments at Lake Michigan and the Chicago River, Dr. Jordan of the experiments at Robey St. and at Lockport, and Dr. Russell at Averyville. The sacks being made of parchment or celloidin were strong enough to withstand the action of the water, but of such a character that while dialyzable substance in the water outside or inside the sacks would be able to pass in or out, the typhoid bacilli could not leave the sacks. The conditions of the water inside the sacks would consequently approach more or less closely to those of the water in which the sacks were placed. The sacks were in the form of long tubes about 2½ inches in diameter, and holding from 200 to 300 c.c. They were mounted either in wooden frames covered with wire screens or in galvanized iron cylinders covered with wire netting. The sacks after being placed in position, were filled with some of the water in which they were immersed and seeded with homogeneous suspensions of fresh cultures of typhoid bacilli. The range used in the Lake Michigan and Chicago River experiments was from 500 to 5,000,000 per cc.; in the Drainage Canal, 180 to 857,000 per cc.; in the Illinois River, 540 to 20,400 per cc. After a period of exposure, which varied from a few minutes to a period of more than two weeks, the contents of the sacks were tested to see whether or not they still contained typhoid bacilli. The four methods on which the most reliance was placed in testing for the typhoid bacilli were the Drigalski and Conradi method, the MacConkey method, the Horrock method, and the Hiss method. Culture plates were made from the different sacks at each time of testing. From these plates colonies which appeared to resemble the typhoid bacilli were taken, and a long series of confirmatory tests applied in each case to determine whether or not the form isolated was, or was not, the true tpyhoid bacillus. As a

result of all these experiments, Dr. Zeit found that although the typhoid bacillus would live from fifteen to twenty days in filtered or distilled Lake Michigan water, in the water of the Lake it appeared to live not more than from five to eight days, and in the dilute sewage of the Chicago River not over three days. Dr. Jordan found that in the sacks suspended in Drainage Canal at Robey St., Chicago, the typhoid bacilli could not be found after an exposure of twenty-eight hours, except in one single experiment when in one sack it was found after an exposure of ten days. In the sacks in the water of the Canal at Lockport, no typhoid bacilli were found after ten minutes' exposure. Dr. Russell found that no typhoid fever germs could be recovered from the sacks, placed in the Illinois River, at Averyville, after three days, except in one case, when it was found after an exposure of nine days. The following table, compiled by George C. Whipple, *Engineering Record*, 50, 747, from the numerous tables given in the report, shows the number of colonies which were tested at each station, and the positive results obtained:

TABLE.—TESTS TO DETERMINE TRUE CHARACTER OF APPARENT TYPHOID COLONIES, CHICAGO DRAINAGE CANAL—ILLINOIS RIVER, AT

| | Robey St. | | Lockport. | | Averyville. | |
|---|---|---|---|---|---|---|
| Time of exposure. | No. of colonies tested. | No. of typhoid colonies. | No. of colonies tested. | No. of typhoid colonies. | No. of colonies tested. | No. of typhoid colonies. |
| 10 minutes | ... | ... | 68 | 63 | ... | ... |
| 1 hour | 49 | 41 | ... | ... | ... | ... |
| 20 hours | 104 | 41 | ... | ... | ... | ... |
| 24 hours | ... | ... | 93 | 0 | 72 | 43 |
| 28 hours | 118 | 89 | ... | 0 | ... | ... |
| 2 days | 221 | 10 | 165 | 0 | 25 | 12 |
| 3 days | 142 | 0 | 202 | 0 | 44 | 14 |
| 4 days | 193 | 0 | ... | 0 | 41 | 0 |
| 5 days | 127 | 0 | 136 | 0 | 61 | 0 |
| 6 days | 133 | 0 | 17 | 0 | 28 | 0 |
| 7 days | 139 | 0 | 119 | 0 | 32 | 0 |
| 8 days | 76 | 0 | 24 | 0 | ... | ... |
| 9 days | 102 | 0 | 59 | 0 | 18 | 1 |
| 10 days | 96 | 3 | 111 | 0 | ... | ... |
| 11 days | ... | ... | ... | ... | 46 | 0 |
| 12 days | ... | ... | ... | ... | 38 | 0 |
| 13 days | ... | ... | ... | ... | 25 | 0 |
| 16 days | ... | ... | ... | ... | 14 | 0 |
| 17 days | ... | ... | ... | ... | 15 | 0 |

As regards the positive result found in the Drainage Canal water at Robey St., after ten days' exposure, Dr. Jordan says: "The sudden appearance of typhoid bacilli on a single plate creates the suspicion that their survival may have been due to some accidental cause, and that they had not persisted in the water of the sack during the whole period covered by the experiments," and Dr. Russell states, as to the finding of a single colony in a sack after nine days' exposure in the water of the Illinois River, at Averyville, "that rational explanation for the presence of a

single colony on the ninth day is not apparent, but in the judgment of the writer (Dr. Russell) the presence of this particular organism is not believed to be of any particular significance in the problem under consideration." The general conclusions reached as a result of all the experiments, are stated as follows by the authors:

"(1) From the experiments recorded in this paper, it appears that under conditions that probably closely simulate those in nature, the vast majority of typhoid bacilli introduced into the several waters studied, perished within three or four days.

"(2) It is theoretically possible that specially resistant cells may occur, which are able to withstand for a longer period the hostile influences, evidently present in water. Our experiments, however, show that, if such resistant individuals exist, they must be very few in number, and constitute only a small fraction of the bacilli originally entering the water.

"(3) It is not the intention of the writers to claim that the behavior of the typhoid bacilli, under the conditions herein described, is representative of all conditions obtaining in all natural bodies of water." LEONARD P. KINNICUTT.

**The Revised Plans for the Purification of the Pittsburg Water Supply.** *Eng. Record*, 51, 133-136.—The recently completed plans are practically new ones. The plant, as proposed, is one of the largest in the world, and is to be built on the north bank of the Allegheny River. The water from the river is to be pumped into sedimentation basins, of which there are to be three, combined capacity 130 million gallons, which is about the maximum daily capacity of the filters. The central basin is much smaller than the other two, and will serve as a receiving basin. The 45 filter-beds are to be each one acre in area, covered, the only ventilation being through thirteen 2-foot manholes in the roof of each filter, and these will be closed when the bed is in operation. The galleries between the filter-beds are to be covered, and the only entrance to the beds is through hydraulically operated 7 by 5-foot sluice gates. The ventilation and heating of the galleries and filters will be done by use of fans and steam coils, lighting by incandescent electric lamps. For scraping the filters and for replacing the scrapings by fresh sand, two plans are proposed. One of these is to do the work by hand, the other by machines. Three portable hydraulic ejecters with their discharges connected to sand washers, will be provided in case hand-scraping is adopted. The filtered water reservoir is to have a capacity of 45 million gallons, the roof to be concrete, covered with three feet of soil, and the only entrance from the outside to the reservoir will be through a few ventilator-holes and a hatch-way, constructed for the entrance and removal of a boat. These will be closed and sealed under normal conditions, and the water in the reservoir

will be entirely shut off from light and air, with the exception of air vents in the inlet gate chamber outside the walls. A low concrete dam will divide the reservoir in two parts, and the inlet and outlet regulating gates will be so arranged that each part of the reservoir can be used separately. From the reservoir, the water is to be carried through two 72-inch riveted steel pipes across the river to a pumping station.

LEONARD P. KINNICUTT.

**The Water Filtration Works at Anderson, Indiana.** BY T. B. LEOPOLD. *Eng. Record*, 51, 125–128.—A description of the proposed plant, mechanical sand filtration, illustrated by diagrams and half-tones. The proposed plant will have an ultimate capacity of eight million gallons daily, and consists of two coagulating basins, 50 feet in diameter and 15 feet inside depth. Four coagulant tanks 18 feet in diameter, and 10 feet deep, two of which are intended for the lime solution, and two for either aluminum or iron sulphate solution, are to be equipped with a stirring device. Six filtering compartments, each capable of filtering one million gallons daily. The filling material is to be 6 inches of crushed quartz, pea size, and 36 inches of No. 1 "Spiral Red Wing" sand. Air under pressure is to be used instead of the mechanical rake when washing the filters.

LEONARD P. KINNICUTT.

**Bacterial Disposal of Sewage.** BY G. EVERETT HILL. *J. Frank. Inst.*, 149 (1905), 1–16.—The paper gives the general principles of bacterial purification, describing and discussing Broad Irrigation, Intermittent Filtration, Contact Beds, Septic Tanks, Wave Filters, and the late Col. Waring's experiments at Newport, R. I.

LEONARD P. KINNICUTT.

**Combined Chemical and Bacterial Sewage Treatment, Withington, England.** *Eng. Record*, 51, 128.—The chemical treatment consists merely in running the sewage, three million gallons daily, half of which is ground water, from sedimentation basins through a channel containing blocks of "alumina ferric." The bacterial treatment, of distributing the chemically treated sewage, after passing through sedimentation basins, by a Mather & Platt automatic distributor on ten first contact beds, each of 2,900 square feet surface, filled to the depth of three feet with screened clinkers and cinders from one-fourth to two inches diameter, and then upon second contact beds similar as regards number, size and filling material to the first contact beds.

LEONARD P. KINNICUTT.

**Some Phases of Sewage Disposal.** BY F. A. BARBOUR. *Eng. Record*, 51, 185–186.—Septic tanks are not always successful. The necessary factors to success are: First, division of the total

capacity into units, so that the time of flow can be adapted to the quality of the sewage. Second, adaptation of the inlet and outlet which will make the entire cross-section of the tank effective. Third, depth of tank, which will allow seasonal variation in the accumulation of sludge, as in winter the solids will greatly increase, but will disappear with rising summer temperature. Covered tanks lessen the odor and prevent the freezing of the scum to any great depth. If the sewage is strictly domestic, the per cent. of solid matter which can be liquefied by the septic tank is large enough to justify the adoption of the process. At Saratoga, N. Y., where tanks of 1,000,000 gallons capacity have been in operation since July, 1903, 65 per cent. of the suspended solids in the sewage have been removed, 75 per cent. of which has disappeared by liquefaction. The effluent from a septic tank should always be aerated before applying it to sand or contact filters. Neglect of adequate aeration has probably been the reason of the difficulty sometimes encountered in purifying a septic effluent. Sand filters will, if the surface is kept clean and open and the sewage applied in doses of such amounts, and at such a rate, as to effect thorough distribution of the sewage over the surface, give an acceptable effluent at all times. The danger with contact beds lies in the clogging of the coarse material by solid matter below the surface where it cannot be removed by raking, and it is advisable to subject the sewage to some preliminary treatment to remove the greater portion of the suspended solids. The plant at Mansfield, Ohio, consisting of septic tanks, 1,000,000 gallons capacity, and 1½ acres of cinder contact bed is successfully treating the sewage from 12,000 people. Success, in any method, depends not only on the general scheme of purification, but also on the attention given to the design of many details. A minute change here and there may make all the difference between success and failure. The choice of a method of treatment depends on local conditions. If a very high degree of purification is necessary, slow sand filtration is the only feasible method, and it may be said "that where suitable sand can be economically obtained, it should be used as the filtering medium. This is because the higher rate methods of contact beds and streaming filters require more expert and constant attention, and cannot turn out an effluent of the same purity."

LEONARD P. KINNICUTT.

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## INDUSTRIAL CHEMISTRY.

**A New Caustic Soda Process.** BY HANS A. FRASCH. *J. Soc. Chem. Ind.*, January 16, 1905.—This process was discovered and endeavors to separate nickel from copper and metals in which copper was dissolved by means of ammonia, the nickel being thrown out as hydroxide.

The process consists in the action of nickel hydroxide upon ammoniated brine solutions, with the formation of nickel ammonium chloride, having the following formula, $Ni(NH_3)_2Cl_2$, $4NH_3$, and sodium hydroxide. The double salt of nickel and ammonia is distilled to drive off the free ammonia, and by the addition of caustic soda or lime to liberate the combined ammonia, at the same time re-forming nickel hydroxide to be used over again, while the sodium hydroxide formed in the process, is concentrated down in the usual way.

In order to obtain a nickel hydroxide not containing a great excess of water, which is disadvantageous in the process, a solution of calcium chloride of about 1.4 specific gravity is used for the distillation. Considerable care must be observed in the formation of the nickel hydroxide that an excess of lime or soda is not used, as a little free ammonium salt in the solution is preferable.

The author claims that an apparatus for a daily production of 10 tons of caustic soda would consist of a converting and distilling vessel of 10,000 gallons capacity, equipped with a reflux condenser, a collecting tank for caustic soda solution equipped with steam coil for recovery of possible excess of ammonia, treating tank for calcium oxide, arranged to serve also for filter, absorber for ammoniated brine, and the ordinary storage tanks, concentrators and fuse pots. The expenditures for equipment of plant, as well as the cost of manufacture by this method, are less than are involved in the manufacture of soda-ash by the ammonia process, with the further advantage that consumers may produce their own caustic solutions direct from salt."

S. P. SADTLER.

**Commercial Fusel Oil.** BY SAMUEL F. BALL. *J. Soc. Chem. Ind.*, January 16, 1905.—After stating the necessity for the determination of alcohol in fusel oil, as required by Customs regulations, so that fusel oil containing excessive amounts of ethyl alcohol may not be imported without the payment of the alcohol tax, an analytical method for the determination is given.

Twenty cc. of the sample are mixed with 20 cc. of benzene, and 60 cc. of saturated sodium chloride solution in a cylindrical graduated separator of about 1 inch in diameter, and graduated to 100 cc. A change of volume will take place, due to the solution of the ethyl alcohol in the saturated salt solution, which change of volume is read off—50 cc. of sodium chloride solution after separation are placed in a distillation flask with 60 cc. of water. Fifty cc. of distillate are caught, and the alcohol estimated by specific gravity and temperature.

"The percentage of alcohol thus found, multiplied by the number of cc. of salt solution after separation, will represent the number of cc. of alcohol contained in the brine, and consequently

the number of cc. which were contained in 20 cc. of the sample; the product of this result, multiplied by 5, will equal the per cent. of ethyl alcohol contained in the sample of fusel oil."

S. P. SADTLER.

**Some Present Problems in Technical Chemistry.** BY PROF. W. H. WALKER, Ph.D. *Electrochem. and Metal. Ind.*, January, 1905.—A definition given by Dr. Walker, which is quoted in his own words, is as follows: "Technical chemistry may be regarded as the performance of a chemical reaction or series of reactions on a scale sufficiently large, and by a method sufficiently economical, to enable the product to be sold at a profit." The problems which confront investigators in technical chemistry may be divided into two classes, those pertaining to the chemical reactions, and those pertaining to the processes necessary in carrying out these reactions. The first part of the definition involves pure chemistry, although the results obtained are utilitarian; the second involves chemical engineering.

Germany leads all other countries in the value of its chemical work, yet does not excel in engineering enterprises, which shows that pure chemistry is really the important study in obtaining the desired results in the field of technical chemistry, as the applications are generally worked out in time, although the results may be hastened or improved by the employment of chemical engineers.

Considerable space is given to a discussion of the fertilizer industry in the United States, in which the product has increased from 1,900,000 tons to 2,900,000. Attention is called to the waste in the valuable constituents necessary for fertilizing, especially the disposal of sewage, which should be returned to the soil. The use of metallurgical slags is cited as a means of obtaining phosphoric acid in practically inexhaustible quantities. Independent supplies of potash salts are looked upon as necessary for the supply of that ingredient, as most of the potash, at present, comes from the Stassfurt region of Germany.

The recovery of potash from wood-ashes is a means of obtaining additional potassium salts; feldspar and the mineral leucite are also possible means of supplying the potash required.

The greatest importance is attached to the supply of available nitrogen, as the sodium nitrate beds of South America are in danger of exhaustion. The atmosphere is looked upon as being the rational supply for the nitrogen required, which will probably be made with sufficient economy by means of electricity. Investigators in this line are the Ampere Chemical Company, at Niagara Falls, who make carbide of barium in the first place, and then convert this into barium cyanide by means of air from which oxygen has been removed, and Siemens & Halske Co., of Berlin, who make use of a process by which ammonia is converted into nitric acid by means of a catalyzing agent.

In addition to these methods of obtaining nitrates, the U. S. Department of Agriculture has carried out a considerable number of experiments with a view of fixing atmospheric nitrogen in the form of nitrates by means of bacteria. Field experiments have shown the wonderful activity of bacterial cultures prepared for these purposes. S. P. SADTLER.

**On the Contents of Carbonate in Electrolytic Potassium Hydroxide Solutions and in Solid Caustic Potash.** BY F. WINTELER. *Electrochem. and Metal. Ind.*, January, 1905.—The author refers to analyses made of German caustic potash, and in 19 samples of so-called 100 per cent. caustic potash percentages of potassium carbonate ranging from 2.4 to 18.4 per cent. were found.

The author shows that in the making of caustic potash with the diaphragm cell or with the gravity process ("Glocken" process), the product was practically free from carbonate, although containing potassium chloride. In the concentration of this solution, and in the casting of the caustic, the carbonate is produced by the action of the carbon dioxide of the air.

Experiments, carried out by the author, show that only about 4 or 5 per cent. by volume of solid potassium carbonate can be taken up by a caustic potash solution of 50° B. at 20° C. Therefore, the additional amount has come in the casting. Furthermore, if the potash is left standing for some time in the fused condition, the larger part of the carbonate settles out at the bottom, and only 3 to 5 per cent. need be in the finished product.

S. P. SADTLER.

**Notes on Electrochemistry and Electrometallurgy in Great Britain.** From the Special Correspondent of the *Electrochem. and Metal. Ind.*, January, 1905.—At a meeting of the Civil and Mechanical Engineers Society, the President, Mr. C. T. A. Hanssen, made several suggestions with regard to changes in English patent laws. A longer duration of patent protection was suggested, in order to repay the heavy expenditure usually incurred in developing and pushing new inventions.

Furthermore, he suggested that patents, instead of being issued at a uniform rate of taxation, should be taxed according to the income derived from the monopoly. This would not only result in considerable revenue from successful patents, but lower the charges of undeveloped inventions.

An additional note, that may be mentioned, relates to experiments upon the use of hypochlorites in sewage purification.

"A gallon of electrozone, containing 4 grams of free chlorine to the liter, would sterilize 1,000 gallons of tank effluent, or 1,600 gallons of filtered effluent. Reckoning electricity at 4 cents a unit, and salt at $6.00 a ton, 1,000 gallons of tank effluent could have been sterilized for 0.7 cents. Such a figure leaves out of

calculation royalty, supervision, and repair and renewal of electrodes."
S. P. SADTLER.

**An Automatic Gas Producer.** *Eng. Min. J.*, December 8, 1904.—Combination suction and pressure producers and suction producers are described.

No gas holders are required, and the space occupied for a 100 H. P. producer is somewhat less than that required for a return tubular boiler of the same power. It is only fed twice a day when under full load, and less when not used continuously.

The gas is made continuously without shutting down to blow up the fire. One lb. of coal per H. P. hour is guaranteed for large sizes, and 1.25 lbs. for small sizes.

S. P. SADTLER.

**Fire Clays of Missouri.** BY H. A. WHEELER. *Eng. Min. J.*, —These clays are divided into two classes, flint fire-clays, and plastic fire-clays.

If the flint clays are given a preliminary burning to remove trouble due to their excessive shrinking, they make the most refractory clays attainable, but are not strong enough without addition of some plastic clay.

These prepared fire-clays will stand a temperature of from 2,300° F., to 3,000° F., and cost from $14 to $35 per 1,000 f. o. b., at the factory.
S. P. SADTLER.

**Carbonizing in Bulk.** BY MR. RIES. *Am. Gaslight. J.*, January 16, 1905.—The chambers have sloping floors, and hold charges of 44 cwt., and require twenty-four hours for distilling.

There is a considerable saving in labor by treating such large quantities of coal at a time, but the gas losses are from 20 to 25 per cent. in illuminating value, and about six in heating value. The amount of ammonia obtainable was not ascertained. The results of the initial test are said to be encouraging.

**The Brunck Process of Extracting Ammonia from Distillation Gases.** *Am. Gaslight J.*, December 12, 1904.—In this process distillation gases, containing ammonia and water, are passed through concentrated hot sulphuric acid (80° to 85° C.). The acid is kept hot so as to prevent the condensation of the steam. The ammonium sulphate formed is removed from the excess of the acid by mechanical means. It is claimed that it is cheaper to instal and run a plant equipped with this process.

Apparatus for 60 coke ovens will cost about $17,500 less to construct, and $7,750 less per annum to maintain than the present system.
S. P. SADTLER.

**How to Safely Expel Air from Gas Apparatus, Mains and Holders.** BY E. C. JONES. *Am. Gaslight J.*, December 26, 1904. —An example is given in blowing air from a stretch of large gas

mains. A good-sized pipe is brought to a point 5 or 6 feet above the surface of the ground. The top of the pipe is fitted with a funnel covered with fine, wire gauze, soldered around the edges. In the pipe is fitted a damper, composed of a sheet of card-board, and below this is a pet-cock from which samples of gas are taken. The gas is collected in a collapsed rubber gas bag, closed with a cock. The test is made at a distance from the blow-off pipe, and made by bubbling gas through soapy water. The gas bubbles will not burn at first when a lighted taper is applied, then they will be found to explode, and afterwards burn slowly with a brilliant flame.

S. P. SADTLER.

**Utilization of Electrolytic Chlorine.** BY OSKAR NAGEL. *Electrochem. and Metal. Ind.*, January, 1905.—The author refers to a paper in the September issue of the *Electrochem. and Metal. Ind.*, in which he says, that in summing up the important means of utilizing electrolytic chlorine, the most important is that of the production of hydrochloric acid, which was omitted.

He believes that the manufacture of hydrochloric acid can be readily accomplished, and electrolytic chlorine used at a profit considerably greater than in the manufacture of bleaching-powder.

The process constists in passing steam and chlorine through red hot coke. This can be done without any danger of explosion, and, by keeping the steam in excess, without admixture of chlorine. The apparatus used is essentially the same as the ordinary gas producer, and the runs are alternated with blow-ups in the same way, except that they may be made 6 or 7 times as long as the blow-ups in making fuel gas.

The coke is maintained at a temperature above 1,000° C. In addition to the hydrochloric acid given off, carbon dioxide, carbon monoxide and hydrogen are formed in accordance with the following equation: $Cl_2 + 3H_2O + 2C = CO_2 + CO + 2HCl + 2H_2$. After the condensation of the hydrochloric acid, the residual gas may be used for fuel or power purposes.

The acid made in this way is very pure, being entirely free from iron and arsenic.

S. P. SADTLER.

**Production of Natural Gas.** *Iron Trade Rev.*, December 1, 1904.—The natural gas utilized in the U. S. in 1903, is estimated by F. H. Oliphant (Bulletin U. S. Geological Survey), as valued at $35,815,360. The principal producers were: Pennsylvania, 45.2 per cent.; West Virginia, 19.2 per cent.; Indiana, 17 per cent.; Ohio, 12.5 per cent. The general average price to consumers was about 15 cents per 1,000 cubic feet. The cost to companies owning their own wells was much less. Gas engines are being largely used for motive power, in units up to 1,000 H. P., consuming as low as 9 cubic feet of gas per horse-power hour.

J. W. RICHARDS.

**A Model Gas Producer Plant.** *Iron Age*, December 29, 1904.—Description of a plant of 16 Morgan producers, capable of gasifying 175 tons of bituminous coal a day, arranged in one building, and served by an overhead coal-carrying crane, which takes coal from a large centrally located bin, weighs it, and dumps it into the automatic revolving feeders of the producers. A boy on the traveling crane charges all the coal used. The ashes are dumped by hand into a traveling skip bucket, which loads them into the same cars, which bring coal to the plant.

J. W. RICHARDS.

**By-products from Coke Ovens.** *Iron Trade Rev.*, December 8, 1904.—Mr. E. W. Parker, in a Bulletin of the U. S. Geological Survey, estimates that 528 companies coked in by-product ovens 5,843,538 tons of coal, in 1903, producing 33,483,431,000 cubic feet of gas, of which 31,049,461,000 feet was sold or used, and the difference is unaccounted for. Of that utilized, 73.9 per cent. was for illuminating purposes, and the rest as fuel gas; the average selling price was 97 cents per 1,000 feet. The coal tar produced was 62,964,393 gallons, valued at 3.49 cents per gallon. About one-fifth of the companies save the ammonia liquor, reporting 64,396,662 gallons, equivalent to 17,479,759 pounds of anhydrous ammonia, or 67,821,465 pounds of ammonium sulphate. Very little progress has been made in the United States in manufacturing chemical products from the coal tar. J. W. RICHARDS.

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## AGRICULTURAL CHEMISTRY.

**Home-grown Protein as a Substitute for Purchased Feeds.** By C. F. DOANE. *Md. Agr. Expt. Sta., Bull.* 98.—The author suggests various legumes which may be grown in Maryland. These, mixed with corn chop, would make a practical balanced ration. The object in growing the bulk of the feed on the farms is to save a portion of the $2,000,000, annually paid out by Maryland farmers for nitrogenous feeding-stuffs.

Methods of growing alfalfa are given. This bulletin also includes feeding experiments, using a ration of alfalfa (or other legumes) and corn, compared to corn silage and mixed grain, the object being to show that as much milk is produced with alfalfa (or other legumes) as with silage when the same amount of grain is used in each case, and that if this grain could be grown on Maryland soils, the great value as a money-saver would be established. The results give weight to these two propositions.

J. A. LECLERC.

**Commercial Status of Durum Wheat.** BY M. A. CARLETON and J. S. CHAMBERLAIN. *Bur. Plant Ind., Bull.* 70.—This bulletin describes the introduction of durum wheat in this country, its

use in foreign countries and its market rating; also its special qualities of commercial value. This wheat has been known as macaroni wheat, but on account of its special adaptability in bread-making it is desired to discard this name and to call it by the more appropriate name of durum wheat. No other kind of wheat, excepting Polish wheat, will make good macaroni, the characteristics of which are given. There are also chemical analyses of macaroni made from different kinds of wheat. There is also found a list of manufacturers of macaroni in the United States and many recipes for preparing this food product. Results of comparative baking experiments and a chemical study of durum flour and durum bread form a considerable part of the bulletin. The total protein is about 3 per cent. greater in durum flour than in flour made from soft winter wheat, and about 0.6 per cent. less than in flour made from Kansas hard winter wheat, the same relation holding true in respect to the amount of gluten and of gliadin + glutenin. The average absorbing power and expansion power are somewhat greater in the case of durum wheat flour. The ash content of durum wheat flour is also higher.

Comparative examination of bread made from different flours shows that that made from durum wheat flour contains more moisture, which it loses at a slower rate; it also contains slightly more sugar and more ash, while the food value is about the same as that of bread made from other flours. Two loaves of bread, one made with durum wheat flour and the other made with hard spring wheat flour, were sent to some two hundred and forty dealers, millers, bakers, and teachers of domestic science, for comparative estimate of the physical characteristics. The answers are tabulated. Remarks on the various chemical and baking tests, progress of the new industry and several cuts complete the bulletin. J. A. LeClerc.

**Destroying Prairie Dogs.** By A. T. Peters and S. Avery. *Neb. Agr. Expt. Sta., Bull.* 86.—The most effective treatment is the use of strychnine and cyanide of potash; the formula for making this remedy is given: Pintsch gas hydrocarbon, which is a by-product and which consists of benzene saturated with gases, and mixed with heavier hydrocarbons is also used and recommended. Other substances, such as carbon bisulphide, gasoline, etc., are used, but these are not so effective nor satisfactory. J. A. LeClerc.

**Relative Profits of Selling Milk, Cream and Butter.** By C. F. Doane. *Md. Agr. Expt. Sta., Bull.* 97.—The author quotes the relative prices paid for milk and cream by dairies in summer and winter. A table also shows the price at which the dairyman may sell milk, butter-fat or butter, based on the price and test of the cream, the table showing that it is more profitable to ship

milk at prices prevailing than to convert it into butter, or to sell it to a creamery. J. A. LeClerc.

**The Babcock Test for N. H. Farmers.** By I. C. Weld. *N. H. Agr. Expt. Sta., Bull.* 114—Results of tests for fat in milk show large variations in fat content between morning and night milk from the same cow, the difference in fat content being as high as 2.2 per cent. Methods of sampling milk and running the Babcock test are given. J. A. LeClerc.

**Food Value of One Pound of Milk Solids in Milk Poor and Rich in Fat Content.** By C. L. Beach. *Conn.* (Storr's) *Expt. Sta., Bull.* 31.—This bulletin contains tables showing that with an increase of solids the various constituents of those solids increase at a different rate, *e. g.*, whereas milk solids increase 45 per cent., the fat increases 95 per cent., casein 47 per cent., sugar and ash 13 per cent. In 100 pounds total solids in milk of varying quality the fat increases from 27.9 to 37.5 pounds; the sugar and ash decrease from 45.5 to 35.6 pounds, the casein and albumen remain at about 25 pounds. Results showed that milk with low fat content produced more beneficial returns than when milk with high fat content was used, *i. e.*, to produce one pound gain in live weight in young animals more total solids were required when fed rich milk than when poorer milk was used.

J. A. LeClerc.

**Wheaten Flour.** By T. Macfarlane. *Lab. Inland Rev. Dept. Ottawa, Bull.* 98.—Analyses of some 75 samples of flour from every part of Canada and also of 7 standard samples from Montreal and 4 from Manitoba are given. These analyses include total nitrogen, total protein, gluten, degree of fineness, acidity and ash. The maximum per cent. of ash is 0.85, thus showing that these flours are free from any inorganic adulterant, *e. g.*, gypsum. The amount of gluten varies from 6.6 to 12.7 per cent. J. A. LeClerc.

**The Relation of Food to Dairy Products.** By F. W. Woll. *Wis. Agr. Expt. Sta., Bull.* 117.—This bulletin contains experiments showing that the best cows are the ones which are able to utilize their food to the best advantage. An increase of 1 per cent. in the fat content of milk required an increased feeding of about 8 pounds dry matter. Chapters on the following subjects are included: "Effect of quality of milk on food requirements"; "Effect of period of lactation"; "Influence of age on milk production"; "Influence of food on fat content of milk." Rations rich in protein produce, as a rule, a richer milk and more milk. The nutritive ratio being narrowed from 1 : 7.6 to 1 : 6.0, due to an increase of digestible protein from 1.85 to 2.2 pounds, the cows increased in weight and the total amount of fat in the milk was greater. J. A. LeClerc.

**Wheat Raising on the Plains and Unirrigated Alfalfa on Upland.** By J. E. Payne. *Colorado Agr. Expt. Sta., Bull. 89* and *90*.—These bulletins are descriptive of some methods of growing wheat and alfalfa in Colorado. J. A. LeClerc.

**Feeding Stuffs.** By F. W. Woll and George A. Olson. *Wis. Agr. Expt. Sta., Bull.* 118.—Thirty-four manufacturers have taken out licenses for the sale of concentrated feeding-stuffs. The fat- and protein-content of these concentrates is guaranteed. A complete chemical analysis is given of the two hundred or more samples collected throughout the state. Microscopical examinations for adulterations were undertaken, as far as time permitted. A discussion of the economic value of each constituent present in the feeds, together with a thorough discussion of the results obtained from the analyses of the different classes of feeds, are given. This Bulletin also contains a reprint of the "Wisconsin Feeding Stuffs Law." J. A. LeClerc.

**Commercial Feeding Stuffs now in the Connecticut Market.** *Conn. Agr. Expt. Sta., Bull.* 147.—Besides the chemical and microscopical analyses of about 300 samples of feeding-stuffs the bulletin contains an explanation and discussion of these results. J. A. LeClerc.

**The Care and Handling of Milk.** Part I, C. E. Marshall and W. R. Wright. Part II, John Michels. *Mich. Agr. Expt. Sta., Bull.* 221.—The authors discuss pure and impure milk; transmission of disease by using milk; influence of feeding on production; the bacteria contained in the milk of the udder; sources of contamination from without, and the proper handling of this food product. J. A. LeClerc.

**Silage vs. Grain for Dairy Cows.** By C. G. Williams. *Ohio Agr. Expt. Sta., Bull.* 155.—This bulletin contains a compilation from other sources of the average composition of feeding-stuffs. The object of the experiment recorded was to determine whether silage could profitably replace a considerable part of the grain in feeding dairy cows. When cows are fed the same amount of dry matter (1) in the form of silage, (2) in the form of grain, it is found that the animal produces more milk and more fat with (1) than with (2). The total amount of water consumed was 466 (in 1) and 337 (in 2) per 100 pounds of dry matter. J. A. LeClerc.

**Soil Inoculation for Legumes.** By George T. Moore. *Bull.* 71, Bureau of Plant Industry, U. S. Dept. of Agr.—The more important literature bearing on the fixation of free nitrogen, beneficial effects of leguminous crops, direct effect of nodules upon legumes, effect of legumes on succeeding crops, inoculation of soil by soil transfer and by nitragin, nature of the organisms and

results of cross-inoculation are briefly reviewed. The method devised and used in the Department of Agriculture for preparing the organisms for distribution is stated in very general terms and directions for using the inoculating material are given. The more important conclusions are as follows: The nodule-forming organism is a true micro-organism having three well-defined stages, consisting of minute motile rods which produce the infection; larger rods, motile or non-motile; and capsulated forms, the so-called "branched organisms." There is but one species of legume organism, *Pseudomonas radicicola* (Beyerinck) Moore. The difference in the infective power of bacteria from different hosts is due to slight physiological variations which can be broken down readily by cultivation. It was satisfactorily demonstrated that it is possible to cause the formation of nodules upon practically all legumes, no matter what was the source of the original organisms, provided they were cultivated for some time upon a synthetic nitrogen-free medium. In order to increase or maintain the virulence of nodule-forming organisms they must be cultivated upon nitrogen-free media, as nitrogenous media tend to diminish and frequently destroy the nitrogen-fixing power. Heat, moisture, alkalinity, acidity and amount of nitrogen in soil all have a direct effect upon legume bacteria and the failure of nodules to develop may often be traced to one of these. Experiments proved that it was possible for the bacteria "to flourish in media containing as high as 0.05 per cent. of $CaCO_3$ and also in media containing an equal percentage of free citric and other similar acids." Pot experiments demonstrated the fact that the bacteria will stand any degree of acidity or alkalinity of the soil that will permit the growth of that particular legume. In general, it may be said that potassium and sodium salts in strengths of from $\frac{1}{3}$ to 1 per cent. often entirely inhibit the formation of nodules, and less quantities reduce the formation considerably, while calcium and magnesium salts greatly favor their production. Nitrogen is fixed by the bacteria in the nodule and becomes available by the action of the plant in dissolving and absorbing the combined nitrogen in these organisms. Nodules inhabited by rod forms of bacteria which cannot be dissolved by the plant are no more benefit than any parasitic gall would be. There is no true symbosis between the bacteria and the host. The bacteria are purely parasitic. Nitrogen-fixing bacteria may penetrate the roots of plants and be of benefit without the formation of nodules or any external evidence of their presence. It is desirable that artificial inoculation be made at the time of planting, but experience has shown that under certain conditions crops of four years' standing are improved by adding bacteria to the soil Inoculation usually fails when the ground is already thoroughly inoculated, when it is rich in nitrogen, when it is too acid or too alkaline to permit the development of either plants or bacteria,

and when the soil is deficient in other necessary plant food. From the reports received from experimenters the percentage of failures to secure benefit from inculation is calculated, rejecting all failures ascribed to bad season, poor seed, presence of organism in the soil, etc. The failures vary from 43 per cent. with soy beans to 9 per cent. with red clover, and average 26 per cent., while the percentage of cases where beneficial results are ascribed to inoculation varies from 42 per cent. with soy beans to 71 per cent. with sweet peas, and averages 51 per cent.

F. P. VEITCH.

**Report of the Chemist.** BY HENRY G. KNIGHT. *14th Annual Report, Wyo. Agr. Expt. Sta.*—Plans for future work include examination of foods, alkali studies, digestion experiments (animal), foreage plant analysis, seepage water studies.

F. P. VEITCH.

## PATENTS.

AUGUST 9, 1904.

767,340. As above for **brazing compound.** Equal parts of boracic acid, carminic acid, calcium carbonate and water are mixed and an alloy of brass and copper made of equal parts. Or equal parts of these mixtures and of boracic acid are made into spelter.

767,352. Fritz Ach, deceased, by M. C. Massie, administrator. Making **xanthine**. Trichloromethyl theobromine is heated with ethyl alcohol, the ester brought into solution by alkali, the alali salt of the theobromine carboxylic acid precipitated by adding acid, finally dissolving the salt in water and adding mineral acid till the corresponding carboxylic acid is separated.

767,353-4-5. As above. The first for suspending thioxanthine in fuming hydrochloric acid, and adding sodium nitrite in water and heating to oxidize, the second uses manganese peroxide, boils and adds first alkali then acid, the third dissolves thioxanthine in sodium hydroxide, adds hydrogen peroxide, then acid.

AUGUST 16, 1904.

767,434–5. Arthur W. Perkins, Rutland, Vt. **Wall plaster and building blocks.** Portland cement and calcined gypsum, 200, each; fire-clay, 500; asbestos, 50; and stucco retarder, 2.5 parts by weight. The second has fire-clay, 300; fire-sand, fire-brick, mica sand, 100 each; mineral wool, 50; and asbestos, 100 parts.

767,499. Clement H. Pierce, Kilbourn, Wis. **Rust preventive.** Boiled linseed oil, 16; beeswax, rosin and propolis, 2 parts each.

767,514. Joseph L. Ferrell, Philadelphia, Pa. **Fireproofing wood.** The wood is boiled first in a solution of calcium chloride, then in one of aluminum sulphate.

767,575. Frederick D. LeBlanc, Lynn, Mass. Assignor one-third to Elzear M. Poirrier, same place. **Cleaning bricks.** The surface of the bricks is sprayed with a mixture of turpentine 8, sea water 1, kerosene 8, alcohol 2, copperas $\frac{1}{8}$, and fresh water 2 parts; this compound is allowed to dry, and is then washed with a mixture of nitric acid 10, salt $\frac{1}{8}$, and fresh water 2 parts.

767,608. Hendricks P. Strahan, Perry, Okla. **Silvering glass.** Silver nitrate 80; water 500; add concentrated ammonia, drop by drop, till the mixture turns white and then clears; make another solution of Rochelle salts 60, to water 500, clean the glass, lay it level in the sun, wash it with ammonia, make a putty rim around it, mix equal parts of the silver and salt solution and pour on, leave it exposed to the sunlight till dry, then coat it with a varnish of Japan, size and asphalt.

767,682. Wm. N. Blakeman, Jr., New York, N. Y. **Drying oil.** Cotton seed oil 85, and tung oil 15, with a drier. Tung oil is from *dipterocarpus turbinatus*.

767,683. As above, for **paint compound.** Adds a pigment to the above.

767,815. Benno Homolka, Frankfort-on-Main, and Nicolaus Schwann, Soden, Germany. Assignors to Meister, Lucius und Bruning, Hochst-on-Main. **Photographic developer.** A developing agent, and an alkali salt of glycocoll.

767,822. Isidor Kitsee, Philadelphia, Pa. **Amorphous cellulose.** Oil or fat is applied to a portion of the surface of a fibrous material, and it is then nitrated, the coated portions escaping full nitration.

767,894. George J. Kaufmann, New York, N. Y. **Pigment.** This patent relates to natural ochres, raw or roasted, analyses of several of which are given.

767,906. Julien H. Mercadier, Louvres, France. **Spongy lead.** A metallic oxide is powdered and kneaded into melted lead. May use zinc oxide.

767,943-4. Isidor Kitsee, Philadelphia, Pa. **Dissolving nitrated cellulose.** Cellulose is nitrated, and then exposed to the fumes of a solvent, as acetic acid or amyl acetate.

AUGUST 23, 1904.

768,101. Frank M. Whitall, Washington, D. C. Assignor fifty-five hundredths to Samuel R. Whitall and Joseph R. Edson, same place. **Dissolving wurzilite.** Powders, and dissolves wurzilite by the aid of heat in dead oil.

768,108. Adolf Zanner, Brussels, Belgium. **Sulphuric acid plant.** In combination, a roasting furnace, a Glover tower and a connecting flue within which concentrating pans are arranged to be fed from without, and worked by the heat of the flue.

768,130. Mieczyslaw Kowalski, Warsaw, Poland, Russia. **Purifying syrup.** The molasses and drainings from sugar-making are diluted with phenol in benzene, which absorbs the impurities, a bleaching-agent as $SO_2$ is added, then separating the reagents added with the impurities from the refined syrup.

768,230. Wm. J. Knox, Pittsburg, Pa. Assignor to Geo. Westinghouse, same place. **Carbon dioxide.** Carbon dioxide is heated and passed through limestone or other carbonate to generate more gas, separating a portion for reheating, and adding steam to increase the yield.

768,259. Otto P. Amend, New York, N. Y. Finishing **skins** and **leather.** Tanned hides are oxidized by treating them with a neutral or slightly alkaline solution of sodium nitrite.

768,264. Ferdinand E. Canda, New York, N. Y. Assignor to Chrome Steel Works, Chrome, N. J. **Composite metal.** An ingot is made with grooves in it, and the whole enveloped with steel of a greater tensile strength than the core so as to prevent the extrusion of the latter in process of working.

768,265. Hugo Carlsson, Sydney, Canada. **Open-hearth steel.** The character of the slag made is controlled by the addition of a titaniferous ore.

768,276. Pedro Fargas-Oliver, Barcelona, Spain. Making **glue.** Gluten is fermented with 3 per cent. of carrot juice, 1 per cent. of oak bark extract added, and the whole mixed with farinaceous and earthy substances, pressed into thin cakes, dried and pulverized.

768,319. Charles H. Webb, Dorking, England. Assignor to The Rapid Cyanide Treatment, London, England. **Extraction of metal.** A cyanide solution is added to the ore in a closed revolving filter with a vacuum on the delivery side, the solid residue being thoroughly washed, and the dried material removed through suitable apertures.

768,389. Georg Merling, Frankfort-on-Main, and Heinrich Eichwede, Hochst-on-Main, Germany. Assignors to Meister Lucius-und Bruning, same place. **Cyclogeraniolidene acetone.** Acetone is added to cyclogeraniol aldehydes in the presence of an alkali, forming a colorless oil, boiling at 132° to 134° C. at ten mm. pressure, and having the odor of cedar wood and violets.

768,398. Martin Greiz, Overlach, Germany, Assignor to Meister, Lucius und Bruning, Hochst-on-Main, Germany. **Pyrazolone compound.** Butyl-chloral hydrate is heated with 4-dimethylamino-1-phenyl-2,3-dimethyl-5-pyrazolone, and the product recrystallized. A yellowish-white powder melting at 85° to 86° C, difficultly soluble in cold water, benzene and ligroin, readily soluble in alcohol and ether, and adapted for use as an anesthetic.

768,404. Alfred Schutt, Charlottenburg, Germany. **Utilizing waste gases.** Hot waste gases are caused to travel in opposite direction to finely divided water in larger quantity than can be made steam by the transfer of heat, the unconverted portion absorbing impurities from the gases, and the mixture is used to heat a liquid of low boiling-point.

768,445. Franz W. Gaertner, St. Petersburg, Russia. **Peat blocks.** Powdered colophony and powdered sulphur are added to peat in the dry and cold state, and then slightly heated and made into blocks.

768,455. Benno Homolka, Frankfort-on-Main, and Friedrich von Bolzano, Hochst-on-Main. Assignors to Meister, Lucius und Bruning, Hochst-on-Main, all of Germany. **Glycollic anilidoorthocarboxylic acid.** Anthranilic acid and glycollide are heated with caustic alkalies, and the leuco body thus obtained is oxidized to indigo in aqueous solution. The acid is in colorless crystals melting at 167° C., scarcely soluble in cold, readily soluble in hot water, alcohol, ether, and acetone.

768,512. Norbert Ceipek, Vienna, Austria-Hungary. **Explosive compound.** Ammonium nitrate 80, aniline nitrate 10, picric acid and potassium nitrate 5 parts each.

768,533. Fritz Ach, by M. C. Massie, administrator. Assignor to C. F. Boehringer Sohne, Mannheim-Waldhoz, Germany. **Theophylline.** 8-Chlorocaffeine is treated with chlorine in nitrobenzene, the latter driven off by steam, the 8-chlorotheophylline filtered, dried and separated.

768,550. Edward Wagner, St. Louis, Mo. **Pasteurizing beer.** Assigned to the Model Bottling Machine Co., St. Louis, Mo. The receptacles containing the beer are first moved through a heating medium, then through a warming chamber, then through a Pasteurizing medium, all in a continuous manner.

768,551-2-3. All to Jose B. de Alzugaray, Bromley, England. **Iron and steel and their alloys.** The first makes refined pig iron from pulverized ore and carbon in excess of that required for reduction, an alkaline solution, a fluoride and a chloride, all briquetted before smelting. The second adds to the above mixture pig iron and scrap. The third makes the bricks of ore and carbon separate from bricks of the fluxes.

768,561. Alfonso M. Clover, Ann Arbor, Mich. **Antiseptic compound.** Succinic anhydride and hydrogen peroxide are caused to react on each other, forming colorless crystals containing 6.8 per cent. active oxygen, moderately soluble in water, alcohol, acetone and acetic ether, insoluble in chloroform and benzene, softens at 115° C., and melts at 128° C., with decomposition and evolution of gas, chiefly $CO_2$. It acts as a germicide on being dissolved in water.

768,562. As above for process of making an **organic peroxide** acid, consisting in mixing powdered succinic anhydride with hydrogen peroxide, stirring and filtering off.

768,563. As above, for the solution in water. Colorless and odorless, is both an acid and a **peroxide,** liberates iodine from potassium iodide, and oxidizes a manganous salt to permanganic acid, and is a powerful germicide.

AUGUST 30, 1904.

768,599. Gustav Goldman, Baltimore, Md. Making **pads.** A mass of fibers are saturated with a solution of Irish moss, then carded wet, and the fluffy mass passed between heated rollers.

768,744. Simon Gartner, Halle on Saale, Germany. **Polychloral.** Pyridine in drops is stirred into chloral with cooling, the mixture solidified, broken into pieces and shaken with dilute hydrochloric acid, the residue washed and dried. Slowly soluble in cold water and cold alcohol, more rapidly in hot solvents, forming chloral hydrate or alcoholate; on heating, evaporates without melting, and split by alkalies into chloroform and formic acid. Used as a soporific.

768,758. Benjamin S. Krupp, Saginaw, Mich. **Photographic screen.** Ground glass is covered with powdered rosin dissolved in wood alcohol, the whole is heated to remove dullness and the process repeated.

768,792. Wm. Everitt, Ilkley, and Thomas Redman, Bolton, Bradford, England. Apparatus for **purifying gas.** A chamber having screens and means for intermittingly directing a forced current of gas against them in alternate directions at high velocity.

768,795-6. Louis Gathmann, Washington, D. C. The first for apparatus, the second for a process of **refining hydrocarbon oils.** A gaseous fluid as air is circulated through the hydrocarbon at less than atmospheric pressure in a closed circuit, the gases absorbed by said gaseous fluid are absorbed prior to its entry into the pump, the fluid is then reheated and sent through the hydrocarbon again.

768,806. George C. Kitchen, Houston Heights, Texas. Assignor one-half to J. B. Brockman, same place. **Insecticide.** Water 1000, unslaked lime 100, calcium carbide 10, copperas 1, camphor $\frac{1}{8}$, gas oil 200, waste oil from Pintsch gas works, 50 parts by weight.

768,809. George M. Lawton, Worcester, Mass. **Dyeing compound.** Logwood to shade set with a mordant of sodium bicarbonate, sumac, nutgalls and flavin, all in powder, 10 each, and fuller's earth, 60 parts.

768,818. John Nelson, Peru, Ill. Assignor to American Nickeloid and Manufacturing Co., same place. **Cleaning sheet zinc.** The sheets are passed through a bath of potassium cyanide 15, sodium carbonate 40, caustic soda 20, and ammonium hydroxide

3,000 to 4,000 parts water, an electric current passed through the bath in the direction of the sheets and back through the sheets themselves.

768,835. Joseph G. Wild, New Haven, Conn. **Gun lubricant.** Assigned to Winchester Repeating Arms Co., same place. Glycerol is saturated with ammonia and mixed with a fixed hydrocarbon, as vaseline.

768,886. Leopold Spiegel, Charlottenburg, Germany. **Soluble compound of iron and arsenic.** A stable mass obtained by evaporating a natural mineral water containing ferrous oxide and ferrous arsenite, and freely soluble in water. The evaporation takes place in an atmosphere of carbon dioxide.

768,938. Joseph L. Guyon, Chicago, Ill. Assignor one-half to Raymond E. Durham, same place. **Polishing bag.** Made of closely woven fabric and filled with whiting and sawdust.

768,972. James A. Aupperle, Indianapolis, Ind. Combined **crucible and preheater.** The crucible has an air inlet and outlet, and an intermediate heater. The incoming air is drawn through a solution of caustic potash.

768,983. Herbert L. Dunn, Hopedale, Mass. Assignor to Draper Co., same place. **Fire-proof concrete.** A thin layer is made of three barrels of cast-iron chips and a pint of sal ammoniac spread on them, a barrel each of Portland cement and sand is added and water sufficient to mix the whole thoroughly.

769,003. Maurice Lilienfeld, Berlin, Germany. **Arc lamp electrodes.** Alkalies or alkaline earths are saponified with rosin, mixed with tar and silicates or carbides, and then with powdered carbon.

769,029. Philip K. Stern, New York, N.Y. **Thermodynamic process** of obtaining power. An explosive engine and an expansive engine are coupled together. A suitable liquid is used in the explosive engine and a volatile liquid is used to cool the explosive engine and apply the heat thus absorbed to running the expansive engine.

769,059. Henry J. Cooke, New York, N. Y. Assignor one-half to Klipstein and Co. **Oxidizing sulphur dye.** The dyed fabric is exposed to the vapor of warm turpentine, oil of cedar, or other essential oils whereby ozone is developed.

769,061. Johann Davis, Barmen, Germany. Assignor to Otto Bredt & Co., same place. Soluble **starch.** Treats starch with a permanganate at about 50° C.

769,078. Ludwig Hatschek, Vocklabruck, Austria-Hungary. **Imitation stone.** Asbestos fibers and hydraulic cement are well mixed in much water, then spread on each other in thin layers till the required thickness is made, pressing and setting the same.

769,087. Thomas H. Ibotson, East Greenwich, and Robert Meldrum, Blackbeth, England. **Asbestos millboards**, etc. Asbestos fiber is pulped with magnesium oxide in a solution of magnesium chloride, the pulp spread on a filter-bed, detached, dried and treated with an alkaline silicate.

769,104. Albro J. Morse, Baltimore, Md. **Treating garbage.** The entire garbage is cooked in a digester to separate it into tankage and tank water, the grease removed from the tank-water, which is added to the tankage and the whole evaporated to a fertilizer.

769,123. Frederick J. Warren, Newton, Mass. **Paving composition.** Asphalt is mixed with naphtha or benzene to serve as a temporary liquefier.

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769,147. John B. Bruckmiller, McKeesport, Pa. **Sediment-removing composition**. Water 20, sulphuric acid 4, turpentine and lye 1 part each by volume.

769,177. Jean A. Mathieu, Georgetown, S. C. Apparatus for **distillation of wood.** Open-work removable baskets are placed in two rows over a central furnace, with trolley tracks overhead for handling the baskets.

769,241. Charles F. Spaulding, Chicago, Ill. **Coking coal.** After the retort is charged and fired, a blast of air and oxygen is directed upwards in the retort.

769,254. Stanly C. C. Currie, New York, N. Y. Assignor one-half to Wm. Courtena, same place. **Extracting precious metals.** The ores are placed in an atmosphere of hydrogen, roasted and treated with alkali, which is removed and acted on with hydrogen sulphide, while the ore is chlorinated and then treated with hydrogen sulphide, while sodium hyposulphite is applied to the residuum.

769,263. John Hermann, Bisbee, Ariz. Utilizing waste **furnace gases.** These gases are applied to metallic oxides to reduce them to lower oxides or to the metallic state, the carbon monoxide is burned to carbon dioxide and the heat values lost by imperfect combustion recovered, and used for an extraneous purpose, while air is admitted to the oxide at intervals to produce continuous work.

769,280. Herbert S. Stark, Johannesburg, Transvaal. Extracting **gold.** The ore is oxidized by air or otherwise in a solution of an alkali sulphocyanide, the gold precipitated and the operation repeated. WILLIAM H. SEAMAN.

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WILLIAM A. NOYES, Editor.



## INORGANIC CHEMISTRY.

**The Dexter, Kansas, Nitrogen Gas Well.** BY E. HAWORTH AND D. F. MCFARLAND. *Science*, 21, 191.—During the latter part of the year 1903, while a drilling for oil was being made near Dexter, Kansas, gas was struck in a sandstone deposit about 400 feet below the surface. This gas could not be burned in a jet. At present the static pressure recorded is 120 pounds, and the flow about 7,000,000 cubic feet in twenty-four hours.

An analysis of the gas showed the following composition: $O_2=0.20$; $CO_2=0.00$; $CO=0.00$; $CH_4=15.02$; $H_2=0.80$; $N_2=71.89$; inert residue = 12.09. Total, 100.00.

The "inert residue" remained after a sparking with oxygen over potassium hydroxide, and the removal of the excess of oxygen in the usual way.

Geologically the mouth of the well is in the Permian and in the gas-bearing sandstone, between the upper coal measure and the lower Permian. The gas occurs in sandstone in a manner similar to that in which natural gas occurs farther east in the state, where there are hundreds of natural gas wells. From all of these wells the gas contains from 2 to 7 per cent. of nitrogen, and usually 89 to 97 per cent. of marsh gas, together with about 1 per cent. of carbon monoxide and 0.2 to 0.4 per cent. of carbon dioxide.

The authors suggest that the nitrogen may owe its origin to air which, in some way, was embedded several hundred feet below the surface, and had afterwards been deprived of the oxygen. The absence of either carbon monoxide or dioxide offers an objection to the explanation. In a comment at the close of the article H. L. Fairchild suggests that the view which regards the earth's atmosphere and hydrosphere as volatile matter forced

out of the interior of a shrinking globe, makes the nitrogen supply in the Dexter well simple and natural. No explanation, however, is given. LAUDER W. JONES.

## MINERALOGICAL AND GEOLOGICAL CHEMISTRY.

**Department of Geology and Natural History, Territory of Oklahoma.** *Third Biennial Report*, 49 pp. BY A. H. VAN VLEET.—There are several contributors to this report, which deals briefly with the geology and economic resources of certain portions of the territory. The absence of noteworthy quantities of the precious metals in the Wichita mountains is again emphasized, and the blame for the groundless boom ascribed largely to unscrupulous assayers who have not hesitated to give false certificates of assay. W. F. HILLEBRAND.

**General Geology. Notes on the Stratigraphy and Igneous Rocks.** BY B. K. EMERSON. *The Results of the Harriman Alaska Expedition, Vol. 4*, pp. 11–56; plates. Chemical data are practically lacking. W. F. HILLEBRAND.

**Geology of the City of New York (Greater New York).** BY L. P. GRATACAP. *Second Edition*, 119 pp.; map, plates, figures. Brentanos, New York. W. F. HILLEBRAND.

**The Mount Vernon Meteorite.** BY WIRT TASSIN. *Proc. U. S. Nat. Mus.*, **28**, 213–217; plates.—This Kentucky pallasite, of which a preliminary account was given by G. P. Merrill (see this Journal, **25**, R 271), has now been submitted to exhaustive chemical examination. The mineral composition, calculated from the results of several analyses, is approximately as follows: Olivine, 63.15; nickel-iron, 33.12; schreibersite, 1.95; troilite, 0.69; chromite, 1.00; carbon, 0.09; chlorine, trace. These mineral constituents were all isolated and analyzed, with the results following: *Nickel-iron alloy*: Fe, 82.52; Ni, 14.044; Co, 0.949; Cu, 0.104; S, 0.288; Si, 0.808; Al, 0.410; C, 0.465; P, 0.390; Cl, trace. *Taenite*: Fe, 63.99; Ni, 35.98; Co, 0.10; Cu, trace; P, 0.04; sp. gr., 7.00. *Schreibersite*: Fe, 64.99; Ni, 18.905; Co, 0.105; P, 15.700; Cu, trace. *Troilite*: Fe, 62.99; Ni, Co, 0.79; P, trace; S, 36.35; sp. gr., 4.759. *Chromite*: $Cr_2O_3$, 64.91; $Al_2O_3$, 9.85; MgO, 4.96; FeO, 17.97; $SiO_2$, 1.38; sp. gr., 4.49. *Olivine*: $SiO_2$, 35.70; MgO, 42.02; FeO, 20.79; $Fe_2O_3$, 0.18; $Al_2O_3$, 0.42; MnO, 0.14; NiO, 0.21; P, trace. A specular material, lining cavities left after extracting olivine, is regarded as essentially a graphitic iron containing sulphur and chlorine. Material wanting in homogeneity gave: Fe, 84.9; Ni,Co, 5.039; Si, 2.99; C, 2.81; S, 1.75; P, 1.47; Cl, 0.1; Al, 0.94. With the author's approval a few typographical errors of names of

constituents determined have been corrected in this abstract.
W. F. HILLEBRAND.

**The Billings Meteorite: A New Iron Meteorite from Southern Missouri.** BY HENRY A. WARD. *Am. J. Sci.*, 19, 240–242; figures.—This rather axe-shaped, coarse octahedrite (Og) was found in 1903, weighed then 54 pounds, and had extreme dimensions of 15¼ x 8¾ x 5 inches. Its surface is rusty, without sure trace of pitting. Prof. O. C. Farrington communicates data on the texture and structure of the iron. Analysis by H. W. Nichols afforded: Fe, 91.99; Ni, 7.38; Co, 0.42; Cu, 0.01; Si, 0.08; P, 0.15; S, 0.06. Total, 100.09.
W. F. HILLEBRAND.

**Autophytography: A Process of Plant Fossilization.** BY CHARLES H. WHITE. *Am. J. Sci.*, 19, 231–236; figures.—Autophytography is a name proposed for the processes by which plants may record their forms on rocks by chemical action during the decomposition of the plant. This action may result in precipitation upon the underlying rock surface of an inorganic substance of a different color, or in the removal of a coloring ingredient from the rock. Illustrations of such changes are given from present and past geological ages.
W. F. HILLEBRAND.

**On the Lamprophyres and Associated Igneous Rocks of the Rossland Mining District, British Columbia.** BY WILLIAM BURTON BARBER. *Am. Geologist*, 33, 235–247; plates.—Eruptive rocks almost entirely make up the area of the Rossland Mining District. These show a certain general relationship with each other. Of the few known American localities for lamprophyres this shows them under least altered conditions. The lamprophyric structure is shared by kersantites, camptonites, minettes and vogesites, which grade into each other. Only typical lamprophyres are described in the paper. Along with them occur hornblende diorite and diorite porphyry. Syenites and monzonites intergrading with each other, likewise occur and are described. Chemical data are wanting.
W. F. HILLEBRAND.

**Dumortierite.** BY WALDEMAR T. SCHALLER. *Am. J. Sci.*, 19, 211–224; figures.—This paper is a condensation of a more elaborate report, which will appear in a bulletin of the Geological Survey. The descriptions are mainly of the lavender mineral from Dehesa, San Diego County, California, and of a blue variety from the State of Washington. The former occurs in radiating lavender masses several centimeters thick, in a dike formed chiefly of quartz and dumortierite. The beautiful pleochroism is from colorless to deep red purple. The dumortierite from Skamania County, Washington, occurs as small blue spherulites (diam. ½ to 1 mm.) in a rock composed of equal parts of andalusite, quartz and muscovite. The dumortierite forms about 2 per cent. of the rock.

The study of crystals from California, Arizona and New York afforded the following results: Axial ratio, $a : b : c = 0.8897 : 1 : 0.6871$, the mineral being orthorhombic; forms noted, (010), (100), (120), (110), (320), (210), (102), (203); crystals imperfect. The following is the average of two analyses of the California mineral, of 3.306 sp. gr.: $SiO_2$, 28.68; $Al_2O_3$, 63.31; $Ti_2O_3$, 1.45; $Fe_2O_3$, 0.23; $H_2O$, 1.52; $B_2O_3$, 5.37. Total, 100.56. The titanium is supposed to replace aluminium. The formula deduced is: $8Al_2O_3,B_2O_3,H_2O,6SiO_2$, or $(SiO_4)_3Al(AlO)_7(BO)H$, which in type is similar to that of andalusite. Other analyses are discussed and shown to agree in the main with the proposed formula. An analysis of the Washington dumortierite is also given, though the sample contained titanite (leucoxene), andalusite and pyrite: $SiO_2$, 28.51; $Al_2O_3$, 59.75; $Fe_2O_3$, 2.48; $TiO_2$, 0.95; $H_2O$, 2.12; $B_2O_3$ 5.54; CaO, 0.68. Total, 100.03. The alteration of dumortierite to muscovite is noted. W. F. HILLEBRAND.

**Crystallography of Lepidolite.** BY WALDEMAR T. SCHALLER. *Am. J. Sci.*, **19**, 225–226.—This is a preliminary note on some crystals from a gem mine yielding tourmaline, topaz and garnet near Ramona, San Diego County, California. The crystals are similar to those of muscovite, though three marked differences are noted: (1) The rarity of twins; (2) the absence of the face M (221); (3) the presence of the face a (100). Common forms are: (001), (010), (100), (023), (112), $(\bar{1}11)$, $(\bar{1}31)$; also (261), $(\bar{1}32)$, (130), and possibly some others. The angles between the same forms varied on different crystals. "It is suggested that this variation......is due to the fact that lepidolite is an isomorphous mixture of two end products and as the ratio of these two end products varies the crystallographic and physical properties of the mineral also vary." W. F. HILLEBRAND.

**Iodobromite in Arizona.** BY W. P. BLAKE. *Am. J. Sci.*, **19**, 230.—Occurs in a vein of quartz and calcite near Globe, Pinal County. The behavior when fused with potassium bisulphate is described, first brown and then violet vapors appearing, which condense in the upper part of the tube. W. F. HILLEBRAND.

**Adsorption in Ore Deposition.** BY W. H. WEED. *Eng. and Min. J.*, **79**, 364.—The author calls attention to the discovery by Köhler (*Z. prak. Geol.*, 1903, p. 49) that clays and certain colloids possess the power of extracting metals from their dilute solutions, and alludes to certain experiments going on in the laboratory of the Geological Survey in extension of this work. "The importance of this process appears to be very great. It not only explains the close association of copper ores and shales, but it promises to be a positive aid in prospecting and mine development. It throws considerable light on the formation of ore-shoots of rich copper in many mines, where, as at Butte, Montana, in Arizona and in

Mexico they occur associated with clays. Moreover, it explains the frequent association of nodular and disseminated copper ores in clays as a secondary product." W. F. HILLEBRAND.

**The Cape York Meteorites.** BY E. O. HOVEY. *Am. Mus. J.*, 5, 3–7; plate and figure.—These three siderites, brought from Greenland by Captain Peary and now in the American Museum of Natural History, probably fell at the same time. Under Brezina's classification they would be called "Broad Octahedrite, (Og)." No. 3 is probably the heaviest meteorite known. Analyses by J. E. Whitfield are as follows:

| | No. I. The dog. | No. II. The woman. | No. III. Ahnigito, or the tent. |
|---|---|---|---|
| Fe........ | 90.993 | 91.468 | 91.476 |
| Ni......... | 8.265 | 7.775 | 7.785 |
| Co......... | 0.533 | 0.533 | 0.533 |
| Cu......... | 0.016 | 0.018 | 0.014 |
| S.......... | 0.019 | none | none |
| P.......... | 0.172 | 0.188 | 0.202 |
| C.......... | 0.014 | 0.020 | 0.028 |
| | 100.012 | 100.002 | 100.038 |

"None of the samples contained silicon or manganese. A trace of chromium was found in the fine oxidized particles from the surface of No. 3, indicating the former presence of a nodule of variable composition." W. F. HILLEBRAND.

**Limestones of Southwestern Pennsylvania.** BY FREDERICK G. CLAPP. *U. S. Geol. Survey, Bull. No. 249*, 52 pp.; maps, plates.—This report will prove of special interest to those contemplating the erection of cement plants in the region under discussion. A great many analyses are reproduced from the reports of the Second Pennsylvania Survey. W. F. HILLEBRAND.

**The Coarseness of Igneous Rocks and Its Meaning.** BY ALFRED C. LANE. *Am. Geologist*, 35, 65–72; plate.—In this paper the author gives some of the results of his studies, devoid of mathematical reasoning, from which he has been led to believe that the size of grain may permit of valuable inferences as to the conditions prevailing at the time of injection and consolidation of fluid magmas. W. F. HILLEBRAND.

**Notes on Some Rocks and Minerals from North Greenland and Frobisher Bay.** BY B. K. EMERSON. *Am. Geologist*, 35, 94–104; plate.—The rocks described are crystalline schists, granites, and basic eruptives, collected at or near Port Foulke many years ago, by the explorer, I. I. Hayes. Chemical matter is lacking, except for two analyses of a banded limestone and a green hornstone. Of special interest are certain phases of a coarse, red

granite, which are characterized by the presence of beautiful, blue quartz, sometimes in bands one and a-half inch thick. In one specimen are grains of blue spinel, and rhombic prisms of a blue mineral that appears to be dumortierite.

W. F. HILLEBRAND.

**Montana Gypsum Deposits.** BY JESSE PERRY ROWE. *Am. Geologist.* 35, 104–113; map, plates, figures.—It is claimed that the state can boast of as large gypsum deposits as any state in the Union. Three fields are recognized, the North, Middle and South fields. The commercially productive deposits lie on the eastern base of the Rocky Mountains. They are numerous, quite thick, and fairly free from impurities.

W. F. HILLEBRAND.

**Economic Geology of the Iola Quadrangle, Kansas.** BY GEORGE I. ADAMS, ERASMUS HAWORTH AND W. R. CRANE. *U. S. Geol. Survey, Bull. No. 238*, 83 pp.; maps, plates.—This report contains chapters on the geology, the mineral resources (chiefly oil, gas and Portland cement materials), and the methods of utilizing the fuel in cement and brick-making and zinc-smelting.

W. F. HILLEBRAND.

**Fuel Testing Plant of the United States Geological Survey.** ANONYMOUS. *U. S. Geol. Survey, Miscel. Publication*, 12 pp.—In the early part of 1904, Congress appropriated $60,000 for elaborate tests of the coals of the United States, during the period of the World's Fair at St. Louis. This pamphlet describes the equipment assembled for boiler, gas-producer, coking, briquetting and washing tests, and for chemical analyses, also the methods of taking samples in the field and laboratory, and carrying out the tests.

W. F. HILLEBRAND.

**Preliminary Report on the Operations of the Coal-testing Plant of the United States Geological Survey at the Louisiana Purchase Exposition, St. Louis, Mo., 1904.** BY EDWARD W. PARKER, JOSEPH H. HOLMES, MARIUS R. CAMPBELL, Committee in Charge. *U. S. Geol. Survey, Bull. No. 261*, 172 pp.—In this report are tabulated, without discussion, the data obtained in carrying out the various tests referred to in the preceding abstract. At the close of the introductory chapter, the chief results shown thus far are summarized as follows:

"(1) The tests in the steam-boiler plant of 65 carload samples of coal from 17 States, indicate the high steam-producing capacity of American coals, and that the quality of many of these coals may be improved by washing.

(2) Most of the American coals and lignites can be used as a source of power in a gas-producer plant.

(3) As indicated by comparative tests of 14 bituminous coals

from 9 States, the power efficiency of these coals, when used in the gas-producer plant, is two and one-half times greater than their efficiency when used in the steam-boiler plant; or, in other words, 1 ton of these coals used in the gas-producer plant has developed, on a commercial scale, as much power as 2½ tons of the same coal when used in the ordinary steam-boiler plant.

(4) Some of the lignites from undeveloped but extensive deposits in North Dakota and Texas, when tested in the gas-producer and gas-engine, have shown unexpectedly high power-producing qualities, such as promise large future developments in those and other States.

(5) Some of the American coals, and the 'slack' produced in mining these coals, can be briquetted on a commercial basis.

A result of the highest importance remains, however, unhinted at, though it will doubtless receive adequate treatment in the final report, one which is revealed by the long list of analyses of mine and laboratory carload lots carried out by Mr. E. E. Somermeier and assistants, under the direction of Prof. N. W. Lord. In these, the moisture loss by air-drying was first determined on the coal crushed to about one-quarter inch size. This air-dry sample was then ground for the proximate and ultimate analyses, and the moisture determined again in the usual manner. The whole analysis was then calculated to the original sample, though the analysis of the air-dry material is also reported in each case. The fact appears that the loss on air-drying is always relatively very large, and often several times greater than that on the air-dry sample. A few examples, taken at random, will illustrate this:

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Moisture in air dry sample... | 0.81 | 1.70 | 5.31 | 5.16 | 7.00 | 10.66 | 15.42 | 18.58 |
| Moisture corrected for loss in air................... | 1.60 | 4.45 | 12.03 | 17.02 | 15.65 | 33.71 | 35.38 | 21.54 |

We are thus taught that the usual moisture determination on a coal ground to fine powder, fails utterly to indicate anything like the true amount in the lump coal as mined, sold and consumed. Mr. Wm. Kent seems to have recognized this long since, for Illinois coals, at least, as appears from his correspondence with the Committee on Coal Analysis of the American Chemical Society, about 1898. The impossibility of grinding coal in a mortar without serious loss of moisture, under ordinary laboratory conditions, was demonstrated by that committee (this Journal **21**, 1121 (1899)), but the extent of the error attaching to, practically, all analyses hitherto made, has never been appreciated. The matter was forcibly brought to the reviewer's attention some six months ago, by the results of a series of analyses of Alaskan coals, made in the Geological Survey laboratory. The moisture was first determined on the coals, ground in a coffee mill, and then after fine grinding. The second value was usually less than half

that obtained on the coarser material, so that coals formerly rated at 8 to 12 per cent. moisture, were found to really contain 15 to 22 per cent., figures still far too low, for the samples had been months out of the ground in tin cans and sacks, and must have suffered loss in reducing to coffee-mill size. This last observation leads to the remark, that the St. Louis corrected results must still be too low, for it is practically certain that, in reducing the coarse, air-dried lumps to fine powder, a marked loss of moisture took place, which is not accounted for in the "corrected" figures. Of course, correspondingly great decreases in the calorific value of the coals are shown in the corrected analyses. The work will be continued under a further grant from Congress, and later reports will be eagerly looked for.

W. F. HILLEBRAND.

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## ANALYTICAL CHEMISTRY.

**A System of Qualitative Analysis Including Nearly All the Metallic Elements. Part II. Analysis of the Tungsten Group.** BY ARTHUR A. NOYES. *Technology Quarterly*, 17, 214–257 (1904). This article constitutes the second part of a comprehensive treatise on qualitative analysis based upon the experimental investigations of the author and his associates. It deals with the "tungsten group" (called the "niobium and tungsten groups" in the preceding article), which comprises those elements whose hydroxides, after heating at 120°, are not dissolved by nitric acid.

"The plan of presentation adopted in the preceding article (this Review 9, 445 (1903)) has been adhered to, special chapters being devoted to a 'Tabular Outline' of the process, to a 'General Discussion' of its main features, to the detailed 'Procedure and Notes,' to 'Test Analyses' showing the efficiency of the method, and to 'Confirmatory Experiments and References,' substantiating the statements made in the notes."

The numerous details of the article cannot be satisfactorily presented in abstract. The work is a most valuable contribution to the literature of qualitative analysis, and promises to be of considerable utility in practical work. The present publication is to a certain extent preliminary in character, and the method of procedure is still subject to revision that may be suggested by future work upon the later groups of elements.

A. W. BROWNE.

**The Determination of Rosin in Soaps.** BY R. E. DIVINE. *Chem. Eng.*, 1, 207–209.—In this article a modification of the method of Twitchell (*Jour. Anal. Appl. Chem.*, 1891) is

suggested. "Three grams of the dry, fatty acids to be tested for rosin content are weighed into a dry, stoppered, 100 cc. flask, dissolved in 25 cc. absolute alcohol, the flask placed in cold water, 25 cc. alcohol saturated with hydrochloric acid gas added, allowed to stand twenty minutes, 10 grams dry, granular zinc chloride added and mixed by swirling, flask cooled, and allowed to stand twenty minutes longer, contents of flask now poured into about 200 cc. water, in a 500 cc. beaker, flask rinsed with weak alcohol, a small stick of zinc added, beaker covered and heated on wire gauze until alcohol is removed, cooled, esters and rosin acids transferred to a separating funnel with ether, ethereal layer washed with water until free from hydrochloric acid, ether distilled off, esters and rosin acids dissolved in neutral alcohol, and titrated with tenth-normal potassium hydroxide and phenolphthalein. In driving off the alcohol, the volume must not decrease below 100 cc."

Esterification is not complete, and hence the results obtained are a little high, but agree fairly well, thus permitting a better comparison of two samples than does the original method. The author refers to the work of Lewkowitsch (*Jour. Soc. Chem. Ind.*, 1893, p. 503), who, using the original method of Twitchell, showed that the combining equivalent of rosin (0.346) varies to some extent. On approximately 50 per cent. mixtures of rosin and fatty acids, the new method gave figures differing by about 0.1 per cent. as against 0.5 per cent. difference with the older one. The modification is welcome, but we still lack a method that is accurate. T. G. DELBRIDGE.

**The Detection of Methyl Alcohol.** BY S. P. SADTLER. *Am. J. Pharm.*, March, 1905, pp. 106–110.—The author reviews various methods described in Allen's "Commercial Organic Analysis," and points out that a negative test for acetone is not proof of the absence of methyl alcohol, since "Columbian Spirits" is free from acetone. He then describes the method of the United States Pharmacopeia: 10 cc. of a 10 per cent. solution of the spirit in distilled water are poured into a 40 cc. test-tube. A copper spiral made by winding one meter of No. 18 copper wire around a glass rod 7 mm. thick, is heated to redness in a flame free from soot, put into a test-tube, held there a second or two, and dipped into water to cool. This operation is repeated five or six times, keeping the solution cool. It is then filtered into a wide test-tube, and boiled gently until the odor of acetaldehyde is no longer noticed. After cooling, 1 drop of a 0.5 per cent. solution of resorcinol is added, and some of this solution poured into a test-tube containing pure sulphuric acid. After standing three minutes, the test-tube is rotated slowly, when the appearance of a rose-red ring means the presence of more than 2 per cent. methyl alcohol. When the

acetaldehyde is not entirely removed, a yellow ring is sometimes noticed, but that disappears immediately.

T. G. DELBRIDGE.

**The Determination of Bismuth by Electrolysis.** BY A. HOLLARD AND L. BERTIAUX. *Bull. Soc. Chim. de Paris*, 31, 113 (1904); *Chem. Eng.*, 1, 245 (1905).—Since the usual methods for the electrolytic determination of bismuth in the presence of copper and lead are unsatisfactory, the authors have worked out the conditions for the more exact separations. Bismuth and copper are separated in sulphate solutions by the addition of an excess of phosphoric acid which forms soluble copper phosphate and insoluble bismuth phosphate. The solution is filtered and the bismuth phosphate goes over into the pyrophosphate on evaporation with concentrated sulphuric acid. The pyrophosphate is dissolved in dilute (1 : 1) nitric acid and electrolyzed. If copper is carried down with the bismuth it is determined colorimetrically. Bismuth and lead are separated in sulphate solution containing alcohol. The alcohol prevents solution of the lead sulphate, while it does not hinder the complete precipitation of the bismuth.

R. C. SNOWDON.

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## ORGANIC CHEMISTRY.

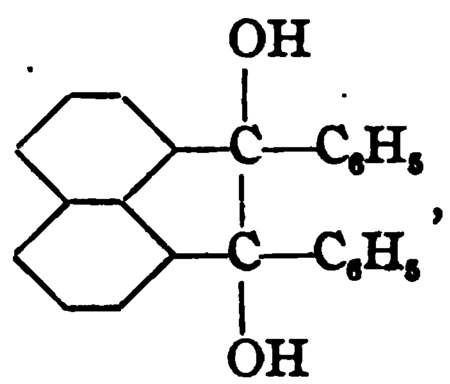
**On the Pinacone-pinacolin Rearrangement.** BY S. F. ACREE. *Am. Chem. J.*, 33, 180–195.—To explain the formation of benzilic acid from benzil and alkali, the author offers the two possible schemes:

$$\text{I. } C_6H_5COCOC_6H_5 + KOH = \begin{array}{c} O \\ \| \\ C \\ | \\ C_6H_5 \end{array} \!\!-\!\!-\!\!-\!\! \begin{array}{c} OK \\ | \\ C \\ | \\ OH \end{array} \!\!-\!\! C_6H_5 = (C_6H_5)_2C(OK)COOH.$$

$$\text{II. } C_6H_5COC(OH)(OK)C_6H_5 \rightarrow C_6H_5COCOOH + C_6H_5K \rightarrow (C_6H_5)_2C(OK)COOH.$$

The author has prepared dihydroxydiphenyldihydrophenanthrene, the corresponding di-*p*-tolyl body and dihydroxydiphenyldihydroacenaphthene, by the action of phenylmagnesium bromide (or the *p*-tolyl compound) on the quinones of phenanthrene and acenaphthene. These were rearranged into the corresponding pinacolins by heating with acetyl chloride. The product obtained from the dihydroxydihydrodiphenylphenanthrene is believed to be a diphenylphenanthrone, $\overline{CO.C_6H_4.C_6H_4.C}(C_6H_5)_2$. Tetralkyl glycols, $R_2C(OH)(CH_2)x(OH)CR_2$, were obtained by the action of Grignard's reagent upon 1,3-, 1,4- and 1,5-diketones, and upon the

esters of various bibasic acids. Grignard's reagent may be used with advantage to convert benzoylformic esters into dialkylglycollic esters, $C_6H_5RC(OH)COOR$. EXPERIMENTAL.—*Dihydroxydiphenyldihydrophenanthrene,* $(HO)(C_6H_5)C.C_6H_4.C_6H_4.C(C_6H_5)(OH)$, melts at 178°-179°, and on oxidation with chromic acid in glacial acetic acid solution gives *o*-dibenzoyldiphenyl (m. p. 165°). *Diphenylphenanthrone,* as obtained by heating the above compound with acetyl chloride, melts at 198° (from glacial acetic acid), and is not easily oxidized by chromic acid. *Diphenylmethyl-o,o-phenylbenzoic Acid,* $(C_6H_5)_2CHC_6H_4C_6H_4COOH$, was obtained by heating the diphenylphenanthrone with alcoholic potash at 150°-190°. It melts at 180°-190°. *Dihydroxydiphenyldihydroacenaphthene,*



melts at 154°. *Sym. diphenyl-di-p-tolylpinacone,* $(C_7H_7)(C_6H_5)C(OH).C(OH)(C_6H_5)(C_7H_7)$, from benzil and *p*-tolylmagnesium bromide, melts at 163°-165°. *β-Di-p-tolyldiphenylpinacolin* (?), $(C_7H_7)_2(C_6H_5)C.COC_6H_5$, from the above pinacone and acetyl chloride, melts at 136°. *Action of Phenylmagnesium Bromide on Ethyl Oxalate.*—Dilthey and Last state that they obtained *β*-benzpinacolin by the action of phenylmagnesium bromide on oxalic ester. The author obtained by this reaction only benzpinacone, and believes that the substance obtained by Dilthey and Last was only impure benzpinacone. *Action of Phenylmagnesium Bromide on Ethyl Succinate.*—*Tetraphenyltetramethyleneglycol,* $(C_6H_5)_2C(OH)CH_2CH_2C(OH)(C_6H_5)_2$, prepared from phenylmagnesium bromide and ethyl succinate, melts at 206° (Dilthey and Last give 202°). It readily loses water and passes into the following anhydride. *Tetraphenyltetramethylene oxide*(?), $O.C(C_6H_5)_2CH_2CH_2C(C_6H_5)_2$, is the only substance obtained when the product of the reaction of phenylmagnesium bromide and ethyl succinate is purified at ordinary temperatures and without any special precautions. It is also formed from the above glycol by boiling a few minutes with acetyl chloride. It melts at 163°-165°. *Diphenyl ethyl glycol,* $(C_6H_5)(C_2H_5)C(OH)CH(OH)(C_6H_5)$, from benzoin and ethylmagnesium bromide, melts at 115°-116°. *m-Tolyldiphenylcarbinol,* $(C_7H_7)(C_6H_5)_2C.OH$, from ethyl *m*-toluate and phenylmagnesium bromide, boils at 255° at 26 mm., and melts at 65°. *The reduction of m-tolyldiphenylcarbinol to m-tolyldiphenylmethane* was accomplished with tin and hydrochloric acid in alcoholic solu-

tion. *The reduction of o-tolyldiphenylcarbinol to o-tolyldiphenylmethane* was effected in similar manner. M. T. BOGERT.

**Notes on Organic Analysis. Part II.** BY HENRY C. SHERMAN. *School of Mines Quarterly*, **26**, 130–183.—(See this Review, **27**, R. 150). The following chapters are given: IV, Aldehydes; V, Carbohydrates—General Methods; VI, Carbohydrates—Special Methods. M. T. BOGERT.

**On the Dibromide of *p*-Nitrophenylcinnamenylacrylic Acid Ester.** BY MARIE REIMER. *Ann. Chem.* (Liebig), **336**, 334–337. The reaction of the dibromide of phenylcinnamenylacrylic acid caused Thiele to assume that in it the bromine atoms were in the 1,4-position, $C_6H_5CHBrCH : CHCBr(C_6H_5)COOH$. The dibromide of the *p*-nitro derivative, however, does not behave in the same way. Its constitution was, therefore, determined by oxidizing the methyl ester in acetone solution with permanganate, and the products obtained, *p*-nitrobenzoic acid and cinnamic acid dibromide, indicate that in it the bromine atoms are in the 3,4-position, $C_6H_5CHBrCHBrCH : C(COOCH_3)C_6H_4NO_2 \rightarrow C_6H_5CHBrCHBrCOOH + O_2N.C_6H_4COCOOH$, the latter further oxidizing to *p*-nitrobenzoic acid. The *dibromide of p-nitrophenylcinnamenylacrylic acid methyl ester* crystallizes in glistening leaflets, m. p. 135°-136°. M. T. BOGERT.

**Some Problems in the Cellulose Field.** BY ALVIN S. WHEELER. 7 pp.—This is the annual address of the presiding officer of the North Carolina Section of the American Chemical Society, delivered in Raleigh, December 3, 1904, and is published as a separate. The formation, constitution, properties and uses of cellulose are briefly discussed, and the unsatisfactory state of our knowledge of the chemistry of cellulose pointed out.
M. T. BOGERT.

**Nature of the Impurities in Raw Wool.** BY J. MERRITT MATTHEWS. *Textile Colorist*, **26**, 323–324, 365–367; **27**, 1–4.—The impurities in raw wool are generally grouped under the following headings: I. *Natural Grease* or *Yolk*, consisting of fatty substances insoluble in water, but soluble in volatile solvents and emulsified by alkaline and soap solutions. II. *Dried-up Perspiration* or *Suint*, consisting chiefly of potassium salts of various organic acids, soluble in water and easily removed by washing. III. *Dirt, Sand, Vegetable Matter, etc.*, mechanically enclosed in the fleece. The various constituents reported in the natural grease or *wool-fat* are listed, and considerable space is given to a discussion of cholesterol and isocholesterol. Beside the wool-fat, which is found on the exterior of the wool fiber, there is another fatty substance, present in the fiber itself, and called *wool-oil* by the author, the chemical character of which has never been thoroughly investi-

gated. *Suint.*—The compounds so far identified in suint are given, the chief acids present being oleic, hyenic, stearic and acetic. But little is known concerning the *coloring-matter* of wool. It appears to be fairly fast towards dilute acids or alkalies, but not very permanent towards light. M. T. BOGERT.

**The Analysis of Dye-stuffs.** BY J. MERRITT MATTHEWS. *Textile Colorist*, **26**, 353–354.—Dyes may be roughly classified as follows: I. Acid Dyes; II. Basic Dyes; III. Substantive Dyes; IV. Mordant Dyes. A series of practical tests, showing the effect of the dye-stuff upon suitably prepared skeins of woolen and cotton yarn are described, by applying which the analyst may determine to which of the above classes any dye-stuff belongs.

M. T. BOGERT.

**Phenylisocyanate as a Reagent for Establishing the Constitution of Tautomeric Compounds.** BY ARTHUR MICHAEL. *Ber. d. chem. Ges.*, 38, 22–49.—According to Goldschmidt and Meissler, "in reactions of tautomeric compounds, which are completed under the influence of electrolytes, the atomic displacements are caused by the free ions." In determining the constitution of tautomeric bodies, therefore, only those reagents should be used in which the possibility of electrolytic dissociation is excluded. Phenylisocyanate should be such a reagent. But, as the author has previously shown that, in its behavior with sodiumformylacetic ester and with sodiumacetylacetic ester, phenylisocyanate gives results opposed to the above hypothesis, its action must be governed by some other law, and the author has investigated the subject from the standpoint of the Law of Neutralization, which is to the effect that in a chemical combination the total energy of the atoms participating in a reaction is the more completely transformed into combined energy and heat, the more nearly the mutually opposed atomic forces counterbalance, and that every chemical system tends toward that arrangement in which the maximum of chemical neutralization is reached. In a critical review of the subject, supplemented by experimental data, the author shows that all the reactions of phenylisocyanate with tautomeric bodies are entirely in harmony with this neutralization law, and best explained from this point of view. Thus, in the case of the sodium derivatives of the acetic ester type, if the structure is such as to permit an addition of the isocyanate, so that a compound results in which the metal is better neutralized than in the mother-substance, this reaction occurs, and the more readily, the greater the potential energy of the metal. Thus—$CH_3C(ONa):CHCOOR$ and $C_6H_5NCO$ give $CH_3C(ONa):C(COOR)CONHC_6H_5$, and not $CH_3C(O.C(ONa):NC_6H_5):CHCOOR$. Where the possibility of such a reaction is excluded, the isocyanate polymerizes, and the ester undergoes deeper-seated changes with

formation of a sodium salt. The observations of Wislicenus on the behavior of $\alpha$- and $\beta$-formylphenylacetic ester with phenylisocyanate are incorrect and misleading, since both forms react with the isocyanate. The use of phenylisocyanate in determining keto and enol forms, as described by Wislicenus, is unreliable, since phenylisocyanate gives the same *C*-addition product with acetacetic ester, as with sodium derivatives. Acetophenone, ethylmalonic ester, malonic ester and ethylacetacetic ester, do not react with phenylisocyanate, even at 100°, while benzoylacetic ester, dibenzoylmethane, formylcamphor, $\alpha$-formylpropionic ester and diacetylmethane form *C*-addition-products with it. It is shown that the ease of addition of the isocyanate to polyketones may not only be lessened by the accumulation of the keto groups, but also that the enol hydroxyl group is thereby protected. By the action of phenylisocyanate upon sodium nitromethane, mono- and disubstituted derivatives were obtained: $(NaO)ONCHCONHC_6H_5$ and $(NaO)ONC(CONHC_6H_5)_2$. EXPERIMENTAL—I. *Sodium ethylate and phenylisocyanate*, in dry ether solution, gave triphenylisocyanate. *Sodium and copper acetacetic ethyl ester and phenylisocyanate* both gave, after acidifying, a compound crystallizing from alcohol in large prisms, m.p. 57°, which, when treated with alcoholic potash, yielded the acid anilide of malonic acid. *Sodium malonic ethyl ester and phenylisocyanate* combined very readily, and the product, on acidifying, gave a substance which, when crystallized from alcohol, formed long, white, prismatic needles, m. p. 126°, from which malonanilic acid was obtained by treatment with alcoholic potash. *Sodium benzoylacetic ethyl ester and phenylisocyanate* gave an addition-product, crystallizing from alcohol in white, prismatic needles, m. p. 145 to 146°, evidently, the monoanilide of benzoylmalonic ester. Warmed with alkali, it gradually dissolved, and a white precipitate separated upon acidifying, more acid in properties than the original substance, and apparently the enol tautomer, since it gradually changed into the original substance again, on standing or when heated. *Sodium Diacetylmethane and Phenylisocyanate.*—The addition-product crystallizes from hot water in prismatic needles, from carbon tetrachloride, in small prisms, m. p. 118° to 120°, and appears to exist only in the enol form, $CH_3C(OH) : C(COCH_3)CONHC_6H_5$. Treated with alkali, it gives acetacetic anilide. *Sodium Formylacetic Ester and Phenylisocyanate.*—The addition-product crystallizes from alcohol in white prisms, m. p. 52° to 53°, and exists only in the enol form, $HOCH : C(COOC_2H_5)CONHC_6H_5$. Its *hydrazone* forms white prisms, m. p. 136°-137°. *Sodium Ethylmalonic Ethyl Ester and Phenylisocyanate.* In addition to triphenylisocyanate (m. p. 274°), a *substance* was obtained, $C_{25}H_{21}O_4N_3$, which crystallized from benzene in small, white prisms, m. p. 141°-142°, of decided acid properties. Its *silver salt* forms white, prismatic needles. The compound obtained with methylmalonic ester melts at 198°-200°.

*Sodium Ethylacetacetic Ester and Phenylisocyanate.* The same compounds were obtained as when ethylmalonic ester was used. *Sodium Formylpropionic Ester and Phenylisocyanate.*—Triphenylisocyanate was the sole product of the reaction. *Sodium formylcamphor and phenylisocyanate* gave the same result. *Sodium Formylphenylacetic Ester and Phenylisocyanate.*—The α-ester was used, and triphenylisocyanate was found to be, practically, the only product. *Sodium nitromethane and phenylisocyanate* gave the anilides of nitroacetic and of nitromalonic acids. *Nitroacetic anilide,* $O_2NCH_2CONHC_6H_5$, crystallizes from water in feathery, bright yellow leaflets, m. p. 138°-139°, and is quite acid in properties. *Nitromalonic anilide,* $O_2NCH(CONHC_6H_5)_2$, crystallizes from alcohol in pale yellow leaflets, m. p. 141°-142°. *Potassium Nitroform and Phenylisocyanate.*—No addition of the isocyanate occurred. II. *Dibenzoylmethane and phenylisocyanate* gave a 90 per cent. yield of the addition-product, which melts at 193° to 207°, depending upon the rapidity with which it is heated. Dissolved in warm dilute alkali, and reprecipitated with carbon dioxide, the enol form separated, and subsequently changed into the keto form on standing. *Benzoylacetic Ester and Phenylisocyanate.*—The product was the same as that obtained from the sodium benzoylacetic ester (see above). *Acetacetic ester and phenylisocyanate* also gave the same product as obtained from the sodium derivative. This product, with semicarbazide acetate, gave a *compound,* crystallizing from alcohol in needles, m. p. 152°-154°, which, recrystallized from water, yielded a *substance* melting at 210°-220°. *Diacetylmethane and phenylisocyanate* gave the same products as the sodium diacetylmethane. *α-Formylpropionic Ester and Phenylisocyanate.*—The addition-product crystallizes from benzene in colorless, glistening, prismatic needles, m.p. 117°-119°. With semicarbazide acetate a *compound* was obtained, crystallizing from water in white needles, m. p. 231°-232°. The addition-product probably has the formula $CH_3C(COH)(COOR)CONHC_6H_5$. Shaken with dilute alkali it yielded a *substance,* m. p. 82°-87°, possibly $CH_3CH(COH)CONHC_6H_5$, and a white neutral *compound* which could not be purified. *Formylcamphor and Phenylisocyanate.*—The addition-product, $C_{18}H_{21}O_3N$, crystallizes from ether in needles, m. p. 138°. *Ethylacetacetic Ester and Phenylisocyanate.*—At 180° a high-boiling *oil* (b. p. 190°-210° at 17 mm.) was obtained, partially solidifying on standing. With methylacetacetic ester similar results were obtained. *Nitroethane and phenylisocyanate* scarcely react upon each other. The same is true of nitromethane and phenylisocyanate. *Behavior of Some Triketones toward Phenylisocyanate. Acetyldibenzoylmethane* reacts with phenylisocyanate at 72°-80° to give a *substance,* m. p. 118°-122°, and a white *compound,* both free from nitrogen. With the acid tautomer (enol form) also, no addition of the isocyanate could be obtained. *Enol diacetylbenzoylmethane*

showed the same behavior. *Phloroglucinol and Phenylisocyanate.*—The addition-product, $C_{27}H_{21}O_6N_3$, crystallizes from benzene or alcohol in white prismatic needles, softening at 186°, and melting at 190°-192°. *Other Investigations on the Behavior of Phenylisocyanate. Acetophenone and phenylisocyanate*, at 180°, gave a thick *oil*, and *crystals*, m. p. 45°-50°. A small amount of *crystals* separated from a mixture of *malonic ester and phenylisocyanate*. From *oxalacetic ester and phenylisocyanate* high-boiling products were obtained, which were not identified. M. T. BOGERT.

**On the Formation of O-Acyl Derivatives from Cyanacetic Ester by the Use of Pyridine and Quinoline.** BY A. MICHAEL AND O. ECKSTEIN. *Ber. d. chem. Ges.*, 38, 50–53.—The Claisen method of forming O-acetyl acetacetic ester from acetacetic ester, acetyl chloride and pyridine, does not work with methyl- and ethylacetacetic esters. Whether an O- or a C-derivative will be formed by the pyridine method depends upon the stability of the primary addition-product (of the acyl chloride and the CO group of the acetacetic ester) toward the base. Thus, cyanacetic ester, with acetyl chloride and pyridine, gives cyanacetacetic ester; and with benzoyl chloride and quinoline cyanbenzoylacetic ester; *i. e.*, in both cases a C-derivative is formed. EXPERIMENTAL. *Synthesis of Cyanacetacetic Ethyl Ester.*—Cyanacetacetic ester was produced by the interaction of ethyl cyanacetate, acetyl chloride and pyridine. It forms colorless needles, m. p. 23°, b. p. 104° at 10 mm. *Semicarbazone*; colorless needles, m. p. 190°. *Synthesis of Cyanbenzoylacetic Ethyl Ester.*—From cyanacetic ester, benzoyl chloride and quinoline (pyridine could not be used) there were obtained a neutral *substance*, crystallizing from dilute alcohol in nearly colorless microscopic needles, m. p. 178°, and cyanbenzoylacetic ester. *Attempt to Synthesize O-Acetyl Ethylacetacetic Ester.*—No acetyl derivative could be obtained from either methyl- or ethylacetacetic ester by treating their pyridine solutions with acetyl chloride. M. T. BOGERT.

## BIOLOGICAL CHEMISTRY.

**A Theory of Protein Metabolism.** BY OTTO FOLIN. *Am. J. Physiol.*, 13, 117–139.—From a study of the quantitative composition of thirty normal urines the author has been led to doubt the validity of the theories of Voit and Pflüger concerning nitrogenous metabolism. According to Voit, the protein of the absorbed food passes through the blood to the different tissues and cells, and is there katabolized under the influence of the living protoplasm, but without first becoming an integral part of the latter. Pflüger's theory, on the other hand, is that all the protein katabolized is first transformed into bioplasm; becomes an integral part of the living tissue, and only as such undergoes the

oxidation that is supposed to constitute the most fundamental chemical decomposition of protein katabolism. The theory of Folin assumes that there are two kinds of katabolism, namely, endogenous and exogenous. By the former is meant the katabolism of protein that has become part of the living tissue and the processes involved are mainly those of oxidation. This form of katabolism is carried on to an extent involving much less nitrogen than that of the exogenous kind, and is a measure of the body's need for nitrogen. The eoxgenous katabolism is the katabolism of the excess of protein introduced into the body and which by a series of hydrolytic cleavages results in a rapid elimination of the protein-nitrogen as urea. Oxidation probably plays a part only in so far as the carbohydrate moiety of the proteins is concerned. According to this theory man uses only a small proportion of the nitrogen introduced daily; the remainder, if not harmful, is at least uneconomical (see Chittenden: Physiological, Economy in Nutrition, 1904, Abstract, this review). F. P. UNDERHILL.

**Measurement of Electrical Conductivity for Chemical Purposes.** BY T. M. WILSON. *Am. J. Physiol.*, 13, 139–154.—By means of an apparatus designed by the author the electrical conductivity of a few drops of blood may be measured and the results obtained agree well with those of haematocrite determinations. Only twenty minutes are required to make the determination of the conductivity of the blood. A number of determinations of the conductivity of the serum and blood in health and disease were made. In thirteen healthy students the conductivity of the serum varied from 84 to 111 and that of the blood from 35.3 to 52.6. In one and the same healthy individual the conductivity of the serum, determined at intervals over a period of more than five weeks, and at various times after taking food and water, varied from 86.5 to 111, and that of the blood from 40.2 to 46.7. In a few cases of disease the conductivity of the serum varied from 91.6 to 105.6, while that of the blood varied from 37.7 to 82.6, the latter in a case of pernicious anemia.

F. P. UNDERHILL.

**The Effect of Salt-Solutions on Ciliary Activity.** BY S. S. MAXWELL. *Am. J. Physiol.*, 13, 154–170.—The results of experiments with the chlorides of lithium, ammonium, sodium, potassium, magnesium, calcium, strontium and barium in $\frac{1}{8}$ mol solutions upon the ciliated epithelium of frog's oesophagus may be summarized as follows: Of the eight salts examined sodium chloride is the most favorable to the prolonged life of the cells and to the preservation of their power to do mechanical work. Arranged according to their effects upon the working power of the cilia, their order is not the same as when arranged according to effects upon duration of cell-life. The physiological action of

these salts upon the frog's ciliated epithelium bears no direct relation to valence of the cations or to molecular weight. In general, salts of higher solution-tension are more favorable than those of lower; but the order of favorable action of the individual salts does not agree with the order of their solution-tensions.

F. P. UNDERHILL.

**On the Determination of the Alkalinity of the Blood Employed by Salkowski and Later by Salaskin.** BY OTTO FOLIN. *Ztschr. physiol. Chem.*, 43, 18–20.—By the addition of known quantities of ammonia to urine and other fluids, Folin shows that the principle of the alkalimetric method of Salkowski (*Centralbl. f. d. und. Wissensch.*, 1898, p. 913) employed by Salaskin (*Z. physiol. Chem.*, 42, p. 195) is incorrect, and accordingly cannot be employed where exact results are desired.

F. P. UNDERHILL.

**The Physiological Relationship of the Proteids of the Blood Plasma.** BY THOMAS STOTESBURY GITHENS. *Am. J. Med. Sci.*, 129, 424–429.—The purpose of this investigation was to determine whether, if an animal was bled freely and then well fed a comparison of the blood before and after the bleeding would show in the latter an increase of proteid. Also to determine whether by starvation a relative decrease of the same form of proteid could be brought about. In this way it was hoped to obtain light upon the nature of the proteid that stood nearest to the assimilation form. The experiments were made on dogs and rabbits. It was found that bleeding followed by feeding resulted in a steady and rapid fall in the per cent. of fibrinogen, although the rise in the albumin was almost as marked. Starvation caused a decrease in the per cent. of albumin, the greater part of which was made up by fibrinogen and englobulin. F. P. UNDERHILL.

**Studies in Mammalian Tubercle Bacilli. III. Description of a Bovine Bacillus from the Human Body. A Culture Test for Distinguishing the Human from the Bovine Type of Bacilli.** BY THEOBALD SMITH. *J. Med. Research*, 13 (New Series 8), 253-301.—The experiments show that the conception of a bovine and a human type of tubercle bacilli introduced by the author in 1898, is confirmed and still further defined. This conception does not exclude that of intermediate types likely to be found in other species. Tubercle bacilli not distinguishable from the bovine type or race are occasionally encountered in the human subject. From their action upon glycerin bouillon mammalian tubercle bacilli may be divided into two groups—one corresponding to the human, the other to the bovine type. Mammals other than cattle are probably infected either from cattle or man, or from both sources. F. P. UNDERHILL.

**The Bacteriolytic Power of Normal Rabbit Serum.** BY B. H. BUXTON. *J. Med. Research*, 13 (New Series 8), 305–319.—1 cc. of fresh normal rabbit serum may be expected to kill the following number of bacteria: Of typhoid, 1,000,000; of paratyphoid, 50,000,000; of cholera, 100,000,000. On keeping the serum it loses its bactericidal power for paratyphoid more rapidly than for typhoid or cholera. Freshly isolated typhoid cultures are not more resistant than stock laboratory cultures. On heating serum for thirty minutes the complements begin to be weakened at 50°, and after progressive weakening at 51° and 52° are finally destroyed at 53°. The weakening for paratyphoid is much more marked than for typhoid or cholera. There appears to be a special complement for paratyphoid of a particularly labile nature. The intermediate bodies for typhoid and paratyphoid are specific for each. On absorbing with one the serum is still bactericidal for the other. On absorbing with cholera the serum loses its bactericidal power for both typhoid and paratyphoid. In this case the complements appear to be absorbed. Absorption by cholera indicates that the complements are general for all three species, an apparent contradiction to the results obtained by heating experiments. F. P. UNDERHILL.

**The Color Reactions of Naphthoquinone Sodium Monosulphonate and Some of Their Biological Applications.** BY C. A. HERTER. *J. Exp. Med.*, 7, 79–111.—Many color reactions of naphthoquinone sodium monosulphonate with various groups of organic compounds are given, together with an outline of their biological applications. F. P. UNDERHILL.

**The Toxic Effects of Formaldehyde and Formalin.** BY MARTIN H. FISCHER. *J. Exp. Med.*, 6, 487–519.—Rats, rabbits, dogs, cats and guinea-pigs when subjected to the action of formaldehyde and formalin develop pneumonia and bronchitis. Whenever and however formaldehyde and formalin are injected, local inflammation of a severe type, which may result in death, is set up. The lethal dose of formalin when injected peritoneally into guinea-pigs is approximately 2 cc. of 1/1000 formalin for each 100 grams of body weight. Formalin is directly or indirectly chemistatic for leucocytes. F. P. UNDERHILL.

**Studies in Haemolysis with Special Reference to the Properties of the Blood and Body Fluids of Human Beings.** BY H. T. MARSHALL. *J. Exp. Med.*, 6, 347–376.—The results observed in this investigation may be summarized as follows: Serum specifically haemolytic for the human blood acts with remarkable power upon the blood corpuscles of *Makakus rhesus* and *Makakus cynomolgus*. In each case the amboceptor closes, for the monkey blood and the human blood were the same, or nearly the same. Rabbit serum specifically haemolytic for monkey blood acts only

feebly upon human blood. There is a great difference in its action, according to the supplementing serum employed. Human blood corpuscles readily pick up from the serum specific for human blood corpuscles amboceptors available for monkey blood, but the human corpuscles do not pick up these amboceptors as completely as the monkey blood corpuscles themselves do. Monkey blood corpuscles pick up from the serum specific for the human blood some of the specific amboceptors. This power is, however, only moderate. Goat, sheep, ox, goose and rabbit serums affect monkey blood to almost the same extent that they do human blood. Human, rabbit and guinea-pig serums fail to produce haemolysis of monkey or human blood. Monkey blood and human blood behave very similarly in the presence of normal active haemolysis. The red blood corpuscles of the infant are dissolved by the serum of various animals, and the action of one kind of animal serum differs from that of another kind. Infant's serum possesses but feeble haemolytic properties, acting only upon rabbits' blood. Human serum contains complement that will reactivate an amboceptor specifically haemolytic for human blood corpuscles. The amount of complement varies with different specimens of serum. The complement available for one amboceptor and that available for another amboceptor may vary independently of each other. The pathologic body fluids contain amboceptor for a variety of bloods. The amboceptor contents of several fluids for a given variety of blood may vary independently of the amboceptor content for another variety. There is more than one group of amboceptors in the fluids. Different fresh sera act in different degrees as complements for the fluids. No amboceptor was found available for human blood. F. P. UNDERHILL.

**A Contribution to the Physiological Differentiation of Pneumococcus and Streptococcus, and to Methods of Staining Capsules.** BY PHILIP HANSON HISS, JR. *J. Exp. Med.*, 6, 317–347. —The experiments recorded in this paper afford some evidence that there are well-marked differences between the metabolic activities of pneumococci and streptococci, which may prove useful in the differentiation of these organisms. These differences become apparent when the organisms are cultivated in an alkaline serum medium, or in a serum medium to which the carbohydrate, inulin, has been added. Pneumococci slowly produce acid in the alkaline serum. In the inulin media they ferment the inulin and thus rapidly give rise to acid. Streptococci do not form appreciable acid in either of these media, nor do they ferment the inulin. The differences between the metabolism of pneumococci and streptococci are indicated by visible changes in the media. Thus the alkaline serum and the inulin serum are coagulated by the acid formed during the growth of the pneumococci. This coagulation is rapid in the inulin serum medium,

slower in the alkaline serum medium. The streptococci, on the other hand, do not bring about a coagulation of these media.

F. P. UNDERHILL.

**On the Preparation of Salt-Free Culture Media, and the Growth of Bacteria upon Them.** BY ALONZO ENGLEBERT TAYLOR. *J. Exp. Med.*, 7, 111–118.—The present paper is a study of the relations of different salts and nutrients to the metabolism of bacteria. All the work previously done on this subject is of doubtful value, since the salt in the culture medium was not controlled or removed. Taylor, by means of a method which combines diffusion with electrolysis, has prepared a solution of gelatine which was practically salt-free. Such a gelatin contains about 0.2 per cent. of sulphur in organic combination. It also contains a trace of phosphorus likewise in organic combination. The ash of 10 grams of this gelatin, water-free, is not weighable. None of the ordinary saphrophytic or pathogenic bacteria will grow upon the medium. Only one bacillus has been observed to develop and even here the growth was extremely slow.

F. P. UNDERHILL.

**The Changes in the Heart Rate and Blood "Pressures" Resulting from Severe Hemorrhage and Subsequent Infusion of Sodium Bicarbonate.** BY PERCY M. DAWSON. *J. Exp. Med.*, 7, 1–32.—These experiments carried out upon dogs led to the following conclusions: If sodium chloride be infused after a severe hemorrhage, the immediate effect is an increase of the blood pressures. Of these the systolic pressure is the most nearly restored to normal. If to the solutions of the chloride an increasing percentage of sodium bicarbonate be added, the rise in the pressures is markedly increased. F. P. UNDERHILL.

**On the Rate of Absorption from Intramuscular Tissue.** BY S. J. MELTZER AND JOHN AUER. *J. Exp. Med.*, 7, 59–79.—In rabbits the effect of intramuscular injections of adrenaline, curare, fluorescein and morphine stands nearest to that of an injection into the circulation, and is far above that of a subcutaneous application. The rapidity of absorption of these substances is much greater after intramuscular injections than is true after subcutaneous injections. F. P. UNDERHILL.

**On the Optical Constants of the Human Eye for Different Colors.** BY CHARLES S. HASTINGS. *Am. J. Sci.*, 19, 205–210.

F. P. UNDERHILL.

**The Examination of the Faeces.** BY IRA S. WILE. *N. Y. and Phila. Med. J.*, 81, 475–478.—A resumé of the composition of the faeces in health and disease. F. P. UNDERHILL.

**The Complimental Relations of Glycuronic and Ethereal Sulphuric Acids and Their Pairlings in Auto-intoxication, Typhoid Fever, and Cancer.** BY A. E. AUSTIN AND E. W. BARRON. *Boston Med. and Surg. J.*, 152, 269–272.—The results of experimental observation by the authors show that aromatic bodies unite both with ethereal sulphuric acid and glycuronic acid, which apparently have a complemental relation to each other, but that the former is always first saturated before union commences with the second. The glycuronic acid varies decidedly in amount, but it is not necessarily associated with the increase of the pairing body, nor with the diminution of oxidation. Furthermore, there is always present an excess of sulphuric acid beyond the demands of the pairing body. F. P. UNDERHILL.

**Uric Acid—Its Influence in Gout.** BY CHARLES C. RANSOM. *Med. News*, 86, 433–435. F. P. UNDERHILL.

**The Use of Food Preservatives.** BY VICTOR C. VAUGHAN. *J. Am. Med. Asso.*, 44, 753–757.—Before a substance should receive legal sanction to be used as a food preservative it should be shown that it is a real preservative, keeping the food in a wholesome condition and not merely retaining the appearance of freshness while bacterial changes continue. In the largest quantities used it must not impair any of the digestive processes. It must not be a cell poison, or if a cell poison in any amount, it must be added to foods only by persons qualified by special training and officially authorized, and foods containing these substances must be labeled and the kind and amount of the preservative employed must be made known not only to the buyer, but to each consumer.

F. P. UNDERHILL.

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## PHARMACEUTICAL CHEMISTRY.

**Ricin Soap; A Valuable Pharmaceutical Adjunct.** BY FREDERICK T. GORDON. *Merck's Rep.*, 14, 74.—Ricin soap is made by dissolving 75 grams of caustic soda in 100 cc. of water, boiling, and adding to this 100 grams of castor oil. Boil until saponification is complete, then pour into moulds, and allow the soap to set. This soap is an excellent one for toilet use, is used as an emulsifier, to make solutions of carbolic acid in water varying in strength between 1 and 50 per cent., for making glycerin suppositories, and for many other purposes.

As an emulsifier its taste is not objectionable, and, though the emulsion may separate in some cases, it is easily re-emulsified upon shaking. To make glycerol suppositories, dissolve 10 parts of the dry soap in 90 parts of glycerol, and pour into moulds. For surgeons' use, dissolve 1 part of the dry soap in 4 parts of phenol. By dissolving proper quantities of this "Carbolic Mixture"

in water, solutions of any desired strength may be obtained. A 2 per cent. ricin soap solution of phenol has been found to be an excellent wash for wounds, which have become soiled with grease and dirt, and for sterilizing surgical instruments.

W. H. BLOME.

**Citrine Ointment.** BY J. H. REDSEKER. *Merck's Rep.*, 14, 80.—The use of red mercuric oxide in place of metallic mercury in the preparation of the ointment of mercuric nitrate, is again recommended. The result of the reaction is all mercuric nitrate without any of the mercurous salt. A larger amount of nitric acid than is directed for the official preparation is required to oxidize all of the fat. W. H. BLOME.

**Methyl Alcohol—What Is It and What Is It Good For?** BY DR. H. W. WILEY. *Am. Jour. Pharm.*, 77, 101.—It is not possible to distinguish between methyl and ethyl alcohol by means of their specific gravities as they are nearly identical. There is a difference of 12° in their boiling-points, but they cannot be satisfactorily separated by fractional distillation. The usual qualitative test depends upon the oxidation of methyl alcohol to formaldehyde, and the production of a red color when the latter is mixed with phloroglucinol. As methyl alcohol is more toxic than ethyl, its use in medicinal preparations, whether intended for internal or external administration, is to be severely condemned. It is suggested, that a small tax be placed upon the manufacture and sale of wood alcohol so as to establish over it the same government supervision as now obtains in the case of ethyl alcohol, and preparations made from it. The French government demands that wood alcohol contain at least 5 per cent. of acetone and 3 per cent. of pyroligneous impurities, thus unfitting it for internal use, at least.

W. H. BLOME.

**The Detection of Methyl Alcohol in Liquids Containing Ethyl Alcohol.** BY SAMUEL P. SADTLER. *Am. Jour. Pharm.*, 77, 106.—Several methods for the qualitative testing of methyl alcohol in the presence of ethyl alcohol. Also the test for wood alcohol, which is to be inserted in the forthcoming pharmacopoeia.

**Progress in Pharmacy.** BY M. I. WILBERT. *Am. Jour. Pharm.*, 77, 131.—Pure quinine sulphate may be readily distinguished from the commercial article by the following test. Dissolve 0.2 gram of the salt in 5 cc. of a mixture of 30 volumes of benzine and 70 of chloroform, filter, and to the filtrate add three times its volume of benzine. If pure quinine sulphate has been used, the filtrate will be perfectly clear. It is claimed that 0.1 per cent. of foreign alkaloids may be detected by this test.

Antichoren is a dark brown, amorphous, soluble substance, said to be mercuric iodochloride. It is easily absorbed, and may be used in place of other mercurials in the treatment of syphilis.

Formane is a combination of formaldehyde and menthol, used as an inhalation in the treatment of colds.

Menthyl camphorate is the camphoric acid ester of menthol, white, insoluble in water and chloroform, but soluble in alcohol and fatty oils, and melts at 86°.

Zinc borate or oxyborate is made by adding to a solution of zinc sulphate a solution of borax to which has previously been added a definite quantity of caustic soda. The resulting salt combines the absorbent properties of zinc with the antiseptic properties of boric acid. W. H. BLOME.

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## INDUSTRIAL CHEMISTRY.

**The Design and Construction of Small Chemical Laboratories.** Written for the *Chem. Eng.*, December, 1904.—Points of interest brought out in this article may be given as follows:

In designing and equipping a laboratory, two aims should be borne in mind: first, to promote accuracy, and second, to economize time and labor. Nothing facilitates rapid work more than by having places for everything, and doing everything in those places.

The laboratory should, if possible, consist of three rooms, two of which should be neatly finished inside and intended for analytical work, and the third, which may be merely a shed, used for the preparation of samples, etc.

Where only one room is available for the laboratory, a small room should be partitioned off from a corner of the large one, for use as balance room and office.

Balances should be mounted on concrete piers running down to foundations independent of the rest of the building. Sampling should, as far as possible, be done in a basement under the laboratory building or the adjoining partitioned room.

Adequate ventilation should be secured by means of sky-lights, or where that is not possible, artificial ventilation by the use of fans should be resorted to.

The floor of the laboratory had best be made of hard wood, so that it can be readily cleaned, concrete and tile floors being hard on the analysts. Where wooden floors are in poor condition, oil cloth or linoleum can be used to advantage.

Where metal is exposed in the laboratory, it may be protected with either aluminum paint or asphalt varnish.

Electric wires should be concealed in the ceilings and walls to protect them from fumes.

The heating of the laboratory should be effected by means of hot water or steam, as hot air is objectionable on account of the dust, which it usually carries.

Excellent plans are given for the interior arrangement of the laboratory, balance rooms, etc.

Description of a satisfactory hood is given, one feature of which provides for a cement floor to the hood made of a mixture of 1 part of cement to 3 of limestone screenings, which have passed through an 8-mesh screen. Lead is also suggested as a substance to cover the floor of the hood.

Where electric lights are used in the laboratory, one should be placed in the hood. The exposed metal work where the globe and socket are joined should be wrapped with insulating tape, so that no metal is exposed. S. P. SADTLER.

**Use of Crude Oil for Fire Assaying.** BY F. C. BOWMAN. *Chem. Eng.*, January, 1905.—The use of crude oil is suggested as a fuel for making fire assays, because of the simplicity of use and economy when the actual number of assays that can be made in a given amount of time, are considered. The burner is one that is easily constructed, and consists of a $\frac{3}{4}$-inch pipe connected by a T with the oil line and through which passes a $\frac{1}{4}$-inch pipe connected with the steam line. This steam pipe passes through a packing nut, which allows of the adjustment of the distance between the opening in the nozzle and the opening in the steam pipe, this distance affecting very materially the flow of the oil, even when the inlet valves of both steam and oil are set.

A cut is given of an assay furnace, which was originally designed for coal or coke, over the grate bars of which fire-brick was placed, running horizontally to a little beyond the middle point of the grate bars, while from there back, fire-brick slanting at an angle of 45°, was placed with bricks at right angles to it at about midway between the flat fire-brick and the rear walls of the furnace, so that the flame impinging upon the slanting bricks would be thrown upwards, instead of against the rear wall.

S. P. SADTLER.

**Apparatus for Sampling Cement.** Written for the *Chem. Eng.*, January, 1905.—The apparatus consists of a small iron pipe about $\frac{3}{8}$ of an inch in bore, closed at one end and drawn to a point. The other end is attached to rubber tubing. The pointed end of the pipe contains a number of small holes, and in order to take a sample, it is thrust down into the cement as far as it is desired to have it go. In this way it does not take up any appreciable amount of the cement.

Exhaust is then applied, and the tube is raised, sucking in cement as it passes up through the different layers. In this way, several pounds can be drawn over into a receptacle used for that purpose.

S. P. SADTLER.

**Effect of Calcium Sulphate in Different Forms on the Setting Time of Portland Cement.** BY RICHARD K. MEADE AND WILLIAM P. GANO. *Chem. Eng.*, December, 1904.—As Portland cement clinker is ground just as it comes from the coolers without

the addition of any retarding substance, the resulting cement sets too quickly. To prevent this, 2 to 3 per cent. of gypsum is usually added with the clinker, or else finely ground plaster of Paris is added just before shipping.

In order to find out just what influence certain forms of calcium sulphate had upon the setting of the cement, experiments were carried out with hydrated and anhydrous calcium sulphate, it being thought that if calcium sulphate with water of crystallization had any influence it was due to a solution of this salt in the cement mixture, rather than any ability it had to absorb water.

The following materials were added, therefore, in small amounts to cement, and pats made up:

(1) Plaster of Paris, $(CaSO_4)_2H_2O$, containing 55.2 per cent. $SO_3$.

(2) Gypsum, $CaSO_42H_2O$, containing 44.6 per cent. $SO_3$.

(3) Dead burned gypsum, $CaSO_4$, containing 58.8 per cent $SO_3$.

(4) Set plaster of Paris, dried in open air, $CaSO_4$, $2H_2O$, containing 46.5 per cent. $SO_3$.

The result of these tests showed that the calcium sulphate with water of crystallization had about the same influence, weight for weight, of actual calcium sulphate, as the anhydrous or dehydrated compounds had.

It would, therefore, seem as if finely ground gypsum would be as satisfactory as plaster of Paris, and obviate the necessity of calcining. S. P. SADTLER.

**The Valuation of Coal for Steaming Purposes.** Written for the *Chem. Eng.*, December, 1904.—Explicit directions for determining moisture, volatile combustible matter, ash, fixed carbon, and sulphur, are given.

The method of determining carbon, hydrogen and nitrogen is also given in detail. In describing the apparatus used for ultimate analysis, the use of 5-pint acid bottles for holding oxygen, might have some novel features. One bottle is placed upon the table, while the other is on a shelf above. Both bottles have openings at the bottom, and are connected by means of rubber tubing. Oxygen is passed into the upper bottle, while water is allowed to run out from the lower one. When the oxygen is all in, the position of the bottles is transposed. The oxygen is made conveniently in round-bottomed glass or copper flasks, with a mixture of potassium chlorate and one-fifth of its weight of manganese dioxide. S. P. SADTLER.

**Gayley Method for Extracting Moisture from Air for Furnace or Converter.** From the American Manufacturer. *Chem. Eng.*, December, 1904.—This method is the invention of James Gayley, vice-president of the U. S. Steel corporation, the process being in operation at the Isabella furnaces of the Carnegie Steel Company.

The purpose of this invention is to make the air of the air blast

used in the furnace contain a minimum and uniform amount of moisture.

A cooling agent, such as anhydrous ammonia or carbonic anhydride from an ice machine, is made to pass through coils of pipes in a chamber through which the air is drawn by means of a fan. The use of this fan is to relieve the blowing machine of a large amount of work due to the back pressure of exhaustion of air by cooling in the chamber through which it passes. When the pipes of the refrigerating chamber become covered with frost, the passage of the air is changed, and hot ammonia gas is run through the coils, in order to melt the frost, while the water resulting therefrom is drawn off. S. P. SADTLER.

**Standard Specifications for Cement.** Taken from a report of the American Society for Testing Materials. *Chem. Eng.*, January, 1905.

GENERAL CONDITIONS.

(1) All cement shall be inspected.

(2) Cement may be inspected either at the place of manufacture or on the work.

(3) In order to allow ample time for inspecting and testing, the cement should be stored in a suitable weather-tight building having the floor properly blocked or raised from the ground.

(4) The cement shall be stored in such a manner as to permit easy access for proper inspection and identification of each shipment.

(5) Every facility shall be provided by the contractor and a period of at least twelve days allowed for the inspection and necessary tests.

(6) Cement shall be delivered in suitable packages, with the brand and name of manufacturer plainly marked thereon.

(7) A bag of cement shall contain 94 pounds of cement, net. Each barrel of Portland cement shall contain 4 bags, and each barrel of natural cement shall contain 3 bags of the above, net weight.

(8) Cement failing to meet the seven-day requirements may be held, awaiting the results of the twenty-eight day tests before rejection.

(9) All tests shall be made in accordance with the methods proposed by the Committee on Uniform Tests of Cement of the American Society of Civil Engineers, presented to the Society, January 21, 1903, and amended January 20, 1904, with all subsequent amendments thereto (see addendum to these specifications).

(10) The acceptance or rejection shall be based on the following requirements.

NATURAL CEMENT.

(11) *Definition.*—This term shall be applied to the finely pul-

vèrized product resulting from the calcination of an argillaceous limestone at a temperature only sufficient to drive off the carbonic acid gas.

SPECIFIC GRAVITY.

(12) The specific gravity of the cement thoroughly dried at 100° C., shall be not less than 2.8.

FINENESS.

(13) It shall leave by weight a residue of not more than 10 per cent. on the No. 100, and 30 per cent. on the No. 200 sieve.

TIME OF SETTING.

(14) It shall develop initial set in not less than ten minutes, and hard set in not less than thirty minutes, nor more than three hours.

TENSILE STRENGTH.

(15) The minimum requirements for tensile strength for briquettes 1-inch square in cross-section shall be within the following limits, and shall show no retrogression in strength within the periods specified.

| Age. Neat cement. | Strength. Pounds. |
|---|---|
| 24 hours in moist air | 50–100 |
| 7 days (1 day in moist air, 6 days in water) | 100–200 |
| 28 days (1 day in moist air, 27 days in water) | 200–300 |
| One part cement, three parts standard sand. | |
| 7 days (1 day in moist air, 6 days in water) | 25– 75 |
| 28 days (1 day in moist air, 27 days in water) | 75–150 |

CONSTANCY OF VOLUME.

(16) Pats of neat cement about 3 inches in diameter, ½-inch thick at center, tapering to a thin edge, shall be kept in moist air for a period of twenty-four hours.

(*a*) A pat is then kept in air at normal temperature.

(*b*) Another is kept in water maintained as near 70° F. as practicable.

(17) These pats are observed at intervals for at least twenty-eight days, and, to satisfactorily pass the tests, should remain firm and hard, and show no signs of distortion, checking, cracking or disintegrating.

PORTLAND CEMENT.

*Definition.*—This term is applied to the finely pulverized product resulting from the calcination to incipient fusion of an intimate mixture of properly proportioned argillaceous and calcareous materials, and to which no addition greater than 3 per cent. has been made subsequent to calcination.

SPECIFIC GRAVITY.

(19) The specific gravity of the cement, thoroughly dried at 100° C., shall be not less than 3.10.

FINENESS.

(20) It shall leave by weight a residue of not more than 8 per cent. on the No. 100, and not more than 25 per cent. on the No. 200 sieve.

TIME OF SETTING.

(21) It shall develop initial set in not less than thirty minutes, but must develop hard set in not less than one hour, nor more than ten hours.

TENSILE STRENGTH.

(22) The minimum requirements for tensile strength for briquettes 1-inch square in section, shall be within the following limits, and shall show no retrogression in strength within the periods specified.[1]

| Age. Neat cement. | Strength. Pounds. |
|---|---|
| 24 hours in moist air | 150–200 |
| 7 days (1 day in moist air, 6 days in water) | 450–550 |
| 28 days (1 day in moist air, 27 days in water) | 550–650 |
| One part cement, three parts standard sand. | |
| 7 days (1 day in moist air, 6 days in water) | 150–200 |
| 28 days (1 day in moist air, 27 days in water) | 200–300 |

CONSTANCY OF VOLUME.

(23) Pats of neat cement about 3 inches in diameter, ½ inch thick at the center, and tapering to a thin edge, shall be kept in moist air for a period of twenty-four hours.

(*a*) A pat is then kept in air at a normal temperature, and observed at intervals for at least twenty-eight days.

(*b*) Another pat is kept in water maintained as near 70° F. as practicable, and observed at intervals for at least twenty-eight days.

(*c*) A third pat is exposed in any convenient way in an atmosphere of steam, above boiling water, in a loosely closed vessel for five hours.

(24) These pats, to satisfactorily pass the requirements, shall remain firm and hard and show no signs of distortion, checking, cracking, nor disintegrating.

SULPHURIC ACID AND MAGNESIA.

(25) The cement shall not contain more than 1.75 per cent. of anhydrous sulphuric acid ($SO_3$) nor more than 4 per cent. of magnesia (MgO).

S. P. SADTLER.

[1] For example the minimum requirements for the twenty-four hour neat cement should be some value within the limits of 150 and 200 pounds, and so on for each period stated.

**The Sulphur Dyes.** BY J. MERRITT MATTHEWS. *Jour. Franklin Inst.*, February, 1905.—For some time no sulphur dyes came upon the market, except the well-known Cachou de Laval and Vidal black. Recently, however, a number of dyes of this class have been brought out, of black, brown, blue, green, olive, yellow and orange colors. The sulphur colors usually appear in the market in the form of large, hygroscopic, blackish lumps, and must, therefore, be kept in packages securely sealed.

Recently, however, the manufacture of these dyes has been improved, and they are furnished in dry powders, which are fairly stable. Some dyes will go directly on cotton, while others require the presence of sodium sulphide in the dye bath.

Care must be taken to avoid any copper or brass fittings being present in the dye bath, as the dye-stuffs are decomposed by such contact. Some dyes require a treatment with metallic salts, such as potassium bichromate and copper sulphate to become fully developed and fast to light. They are, however, more stable to influences of exposure to light than other synthetic colors, with the exception of indigo and aniline black. They also stand acid baths which make them stable where cotton is dyed first and wool afterwards in an acid bath.

The colors do not injure the fabrics, if excess of sodium sulphide is removed by washing, which would itself cause a weakening of the fiber. S. P. SADTLER.

## AGRICULTURAL CHEMISTRY.

**The Chemical Composition of Apples and Cider.** BY WILLIAM B. ALWOOD, R. J. DAVIDSON AND W. A. P. MONCURE. *U. S. Dept. Agr. Bur. Chem. Bull. No. 88*, p. 46.—Part I. "The Composition of Apples in Relation to Cider and Vinegar Production." Forty-nine varieties of summer, autumn, winter and crab apples were studied to ascertain the yield and composition of juice and pomace.

The following tables show the average percentage and composition of the juice and pomace obtained after pulping and pressing:

JUICE.

| | | | Composition—Grams per 100 cc. | | | | | |
|---|---|---|---|---|---|---|---|---|
| Varieties. | Amount of juice. Per cent. | Specific gravity. | Solids. | Total sugar as invert. | Invert sugar. | Cane-sugar. | Acids as $H_2SO_4$. | Tannin. |
| Summer | 48.91 | 1.049 | 12.33 | 9.53 | 5.85 | 3.50 | 0.33 | 0.040 |
| Autumn | 50.72 | 1.054 | 13.76 | 10.66 | 6.93 | 3.53 | 0.36 | 0.069 |
| Winter | 52.16 | 1.056 | 14.29 | 11.43 | 7.04 | 4.16 | 0.41 | 0.050 |
| Crab apple | 57.31 | 1.062 | 15.69 | 11.71 | 8.08 | 3.45 | 0.50 | 0.122 |

POMACE.

| Varieties. | Amount of pomace. Per cent. | Composition. Water. Per cent. | Ash. Per cent. | Total sugar as invert. Per cent. | Invert sugar. Per cent. | Cane-sugar. Per cent. | Acids as $H_2SO_4$. Per cent. | Tannin. |
|---|---|---|---|---|---|---|---|---|
| Summer..... | 47.74 | 83.29 | 0.37 | 8.66 | 5.49 | 3.00 | 0.33 | 0.010 |
| Autumn..... | 47.66 | 80.81 | 0.37 | 9.12 | 6.32 | 2.66 | 0.32 | 0.055 |
| Winter...... | 45.59 | 80.98 | 0.35 | 9.34 | 6.13 | 3.10 | 0.39 | 0.079 |
| Crab apple.. | 41.42 | 70.85 | 0.48 | 10.25 | 6.85 | 3.23 | 0.51 | 0.127 |

The analyses show a gradual increase in solids and total sugars in passing from summer to winter varieties, and in the best varieties there appears to be a fairly definite relation between the sugar and acid contents. It is shown that the percentage loss of sugar in the pomace is very great, amounting, with the summer varieties to 47.10 per cent., with autumn varieties, 44.72 per cent.; with winter varieties, 41.67 per cent.; and with crabapples, 38.80 per cent. of the total sugars.

PART II.—"The Composition of Cider, as Determined by Dominant Fermentation with Pure Yeasts." Fermentation experiments were made, extending over two seasons, with different pure yeast cultures. Three musts were used in the experiments, agreeing very closely in composition; the finished ciders obtained from them show a striking uniformity in specific gravity, acids, and sugar-free solids. The alcohol content, however, varied materially with samples made from the same must, but fermented with different yeasts, thus affecting the character of the beverage. Analyses of a number of commercial American-made ciders are given for comparison; these ciders are extremely variable in composition and quality, and in striking contrast with those made under uniform conditions, and with pure yeast cultures.

L. S. MUNSON.

**The Anatomy of the Peanut with Special Reference to Its Microscopic Identification in Food Products.** BY A. L. WINTON. *Rep. Conn. Agr. Expt. Sta.*, for the year ending October, 1904.—This article treats of the histology of the peanut in a very thorough and concise manner. Previous literature on the subject is reviewed and five cuts of microscopic sections are given. The publication of the data for the detection of peanuts in cattle food and confectionery is also given. Cattle foods frequently include unhulled peanuts as well as damaged and immature fruit. In such cases, the writer calls attention to the characteristic "pitted hypoderm cells (usually of quadrilateral form) and the various elements of the fiber layer, particularly the T-shaped, the L-shaped, the toothed, and the halberd-shaped forms." When the seed of the peanut alone is present, as in the case of peanut butter and Spanish mixtures of chocolate and peanut cake, the author calls attention to the character of the starch and the "tissues of the testa of which

the porous, sharply polygonal cells of the outer epidermis, and the spongy, parenchyma cells, often with narrow arms, are most useful in diagnosis. Fragments of the testa, brown or red on the outer, yellow on the inner surface, can often be picked out under the dissecting microscope." W. D. BIGELOW.

**Report of State Analyst.** BY R. E. DOOLITTLE. *Annual Report of the Michigan Dairy and Food Commission for 1904.* The results of the year's work in the examination of miscellaneous foods are given in tabular form, in such a manner as to make them readily accessible for comparison. The interpretation of the results are given in the text, and their bearing on the law of the State. The methods employed were those of the Association of Official Agricultural Chemists. The following summary of the analytical results is also included in the report.

SUMMARY.

| Article. | Total. | Not found adulterated. | Found adulterated. |
|---|---|---|---|
| Allspice | 3 | 2 | 1 |
| Baking-powder | 1 | 1 | .. |
| Buckwheat flour | 2 | 2 | .. |
| "Buckwheat four compound" | 3 | .. | 3 |
| Butter | 4 | 2 | 2 |
| Canned goods | 2 | 2 | .. |
| Chocolate and cocoa | 39 | 21 | 18 |
| Cinnamon | 4 | 4 | .. |
| Cream of tartar | 11 | 4 | 7 |
| Ethereal flavoring | 12 | .. | 12 |
| Flavoring powder | 4 | .. | 4 |
| Ginger | 4 | 4 | .. |
| Honey | 4 | 2 | 2 |
| Horse-radish | 1 | 1 | .. |
| Jellies, jams and preserves | 97 | 26 | 71 |
| Lard | 5 | 2 | 3 |
| Lemon extract | 159 | 103 | 56 |
| Mace | 2 | .. | 2 |
| Milk | 584 | 532 | 52 |
| Molasses | 15 | 10 | 5 |
| Mustard (flour) | 16 | 6 | 10 |
| Mustard (prepared) | 4 | .. | 4 |
| Pepper | 129 | 55 | 74 |
| Picalilli | 1 | 1 | .. |
| Syrup | 7 | 2 | 5 |
| Vanilla extract | 92 | 36 | 56 |
| Vinegar | 74 | 19 | 55 |
| Totals | 1279 | 837 | 442 |

Special attention is given to the use of methyl alcohol in flavoring extracts, and to the use of terpenless extract of lemon.

W. D. BIGELOW.

**Examination of Food Products Sold in Connecticut.** BY A. L. WINTON, E. M. BAILEY, A. W. OGDEN AND KATE G. BARBER. *Rep. Conn. Agr. Expt. Sta.*, for the year ending October, 1904.—This report gives the results of the analyses of 1818 samples of food products. The results obtained for each class of foods are tabulated, and a complete summary is given, which is as follows:

SUMMARY OF THE RESULTS OF EXAMINATIONS OF FOOD PRODUCTS IN 1904.

| Sampled by the station. | Not found adulterated. | Adulterated or below standard. | Compounds. | Total No. examined. |
|---|---|---|---|---|
| Milk | 288 | 28 | .. | 316 |
| Condensed milk | 24 | 4 | 0 | 28 |
| Noodles | 0 | 22 | 0 | 22 |
| Buckwheat flour | 41 | 16 | 15 | 72 |
| Baking-powder | 50 | 10 | 0 | 60 |
| Cream of tartar | 72 | 19 | 0 | 91 |
| Coffee | 15 | 13 | 0 | 28 |
| Spices | 118 | 58 | 1 | 177 |
| Prepared mustard | 4 | 10 | 0 | 14 |
| Catsup and chili sauce | .. | 81 | 0 | 81 |
| Total | 612 | 261 | 16 | 889 |
| **Sampled by individuals.** | | | | |
| Milk | 170 | 10 | 0 | 180 |
| Cream | 16 | 1 | 0 | 17 |
| Spices | 6 | 2 | 0 | 8 |
| Miscellaneous | 20 | 6 | 0 | 26 |
| Total | 212 | 19 | 0 | 231 |
| **Sampled by dairy commissioner.** | | | | |
| Butter | 5 | 0 | 0 | 5 |
| Molasses | 411 | 8 | 0 | 419 |
| Vinegar | .. | .. | .. | 274 |
| Total | 416 | 8 | 0 | 698 |

Total number of samples examined, 1818

The authors' treatment of the subject of noodles has already been published in this Journal. Aside from this, the articles relating to condensed milk, buckwheat flours, baking-powders and spices are of special interest.

W. D. BIGELOW.

**Nebraska State Food Commission.** BY W. F. THOMPSON, Deputy Commissioner.—This is the report of the commission for the two years ending October, 1904. It gives the results of the

analyses of milk, vinegar, flavoring extracts, syrups, tomato catsup, cider, fruit products, canned goods, and a number of miscellaneous samples. The analysis of each sample is given separately. The results are not tabulated, and no summaries are given. The analytical work was, presumably done by Mr. E. L. Redfern, chemist of the commission. W. D. BIGELOW.

**The Examination of Food Products.** BY B. W. KILGORE. *Biennial Report of the Commissioner of Agriculture of North Carolina*, for the year ending October, 1904.—The article gives a summary of the results obtained in the examination of foods for each year since the beginning of inspection in that state in 1900. The detailed reports regarding this work have been previously published. W. D. BIGELOW.

**Discussion of Amount of Protein Required in the Rations for Dairy Cows.** BY C. L. BEACH. *Conn. (Storrs) Agr. Expt. Sta., Bull. 34.*—This bulletin gives the results of observations for definite periods made with 40 different herds of cows from 1892 to 1901, with respect to the weight of milk-flow, butter-yield of milk, kinds, weight and cost of foods used. Twenty herds received less than 2.01 pounds of digestible protein per day, and 20 herds received more.

The former produced an average of 16 pounds of milk and 0.87 pound of butter, at a cost of 19.03 cents; the latter, 18.6 pounds of milk and 1.03 pounds of butter, at a cost of 22.45 cents. These results practically offset each other. The food requirements of cows are also discussed, reference being made to the German and American standards. J. A. LECLERC.

**Inspection of Concentrates.** BY J. B. LINDSEY, *et. al. Mass. Agr. Expt. Sta., Bull. 101.*—In this bulletin are included analyses of the fat, protein, fiber, and water content of cottonseed meal, linseed meal, gluten meal and feed, distillers' dried grains, malt sprouts and the various cereal residues, besides poultry feeds, such as meat scraps, meat and bone meal, fish, etc. A table is given showing the market price of the various feed-stuffs from July to November, and the weight of one quart of the samples.

J. A. LECLERC.

**Sugar Beets.** BY F. W. TRAPHAGEN. *Mont. Agr. Expt. Sta., Bull. 52.*—This bulletin treats of the crop of 1903, gives the requisites for the location of factory, cost of operation, method of beet culture and statistical data relative to the beet-sugar production of the world. The result of beet culture in Montana in 1903, is reported as unsatisfactory, when compared with that of preceding years. J. A. LECLERC.

**Salt in Butter.** Report of the Iowa Educational Butter Contest. BY G. L. MACKAY AND C. LARSEN. *Iowa Agr. Expt. Sta., Bull. 80.*—Butter from 55 exhibitors was obtained for the educational test, and scored both at Ames, Iowa, and at New York, some 223 samples being thus examined.

These butters were also analyzed, the object of the competition being to determine localities where poor butter was made, to find out the variations in chemical composition and scoring of butter made during different seasons, and to determine the effect of the varying constituents of butter upon the quality.

Table I shows that the 43 samples of May butter obtained the highest score. These butters contained the highest per cent. of salt, and the lowest per cent. (except in the case of the August butters) of curd, the per cent. of fat and moisture being about the average.

Summer butter contains more salt and less curd.

Of the 221 samples analyzed, the following show variation of the constituents:

| | Maximum. | Minimum. |
|---|---|---|
| Water | 20.67 | 7.56 |
| Salt | 6.70 | 0.10 |
| Curd | 3.[illegible]7 | 0.64 |

From the scoring, both at Ames and at New York, it was found that "the quality of cream and methods employed in the manufacture of the butter have more to do with the quality of butter than the composition." Of the samples analyzed, 23 only contained a per cent. of water either greater than 15 or less than 10. The average salt content was 1.96 per cent. F. W. Bouska conducted experiments on the effect of the salt content on the growth of micro-organisms, and found that deterioration is materially checked in butter containing 6 per cent of salt.

An experiment on the solubility of salt in fat gave results showing that pure fat in itself does not dissolve salt, that the salt is dissolved in the water contained in butter and the greater the per cent. of water, the more salt a butter may contain; "the condition in which water occurs in butter seems to lessen its property of dissolving salt." J. A. LECLERC.

**California Report.** June, 1903–June, 1904, page 49.—M. E. Jaffa presents in this report the analyses of the carob bean, *Sesbania Macrocarpa*, cactus plant, besides sesame oil-cake and cottonseed oil-cake. The results show that the carob bean with 15.22 per cent. of protein and the *Sesbania Macrocarpa* with 31.67 per cent. of protein are very nutritious foods for animals. The cactus plant contains 75 per cent. of water, and 15.6 per cent. of carbohydrates.

The composition of twelve different brands of table salt is here included, which, besides 98-99.8 per cent. NaCl, all contain varying

amounts of $CaSO_4$, $CaCl_2$, $MgCl_2$, $H_2O$, and some insoluble matter.

Other substances analyzed are onion chaff, gypsum, volcanic ash, magnesite, wheat and dairy products. The gluten content of the samples of wheat indicate a deterioration when grown in California. J. A. LeClerc.

**Standards of Purity for Food Products.** Circular 13, Office of the Secretary, U. S. Dept. of Agr.—This circular supersedes circular No. 10. The Standards Committee of the A. O. A. C., comprising William Frear, E. H. Jenkins, M. A. Scovill, H. A. Weber, and H. W. Wiley, submits standards for grain and grain products, refiners' syrups, honey, wine and vinegar, which are recommended for adoption, and also "schedules of additional standards submitted in a tentative form." J. A. LeClerc.

**Arizona Experiment Station.** *15th Annual Report.*—This report contains a comparison of feeding alfalfa alone, and mixed rations to two lots of 4 steers each, showing that feeding the former is far more advantageous.

A comparison of the use of potassium bichromate and of formalin as preservatives of milk to be tested by the Babcock method resulted, after a period of sixteen weeks, in no decided preference for either the one or the other. However, because the bichromate colors the milk and thus gives warning of its presence, it is to be preferred.

The report also contains notes on *Sesbania Macrocarpa*, and the possibility of its use in the preparation of an excellent fiber.

The analyses of several varieties of cactus with and without fruit are given, showing their value as forage plants. The ash content of these cacti on dry basis is one of the most striking characteristics, the per cent. varying from 12 to 23. This high ash content is supposed to account for their purgative effect upon cattle. The per cent. of water varies from 74.04-88.00.

J. A. LeClerc.

**The Pear Scab.** By R. E. Smith. *California Agr. Expt. Sta., Bull. 163.*—This bulletin is descriptive of the damage done by the pear scab, and gives direction for spraying and formulas for the preparation of Bordeaux mixture, lime sulphur and salt solution, and arsenical Bordeaux mixture. J. A. LeClerc.

**Formulas and Notes on Spraying.** By A. E. Steen. *R. I. Agr. Expt. Sta., Bull. 100.*—This bulletin gives information as to time of spraying, what insecticide or fungicide to use, and the formulas for their preparation. Although it is not a complete spraying calendar, it gives most of the remedies in common use.

J. A. LeClerc.

**Poultry Feeding and Proprietary Foods.** BY M. E. JAFFA. *California Agr. Expt. Sta., Bull. 164.*—The many requests for information concerning the composition of proprietary foods for poultry, led the author to make a systematic analytical study of those on the market. This bulletin, therefore, contains the analyses of some 37 of these foods, giving the water, ash, fat, carbohydrate, fiber and protein content. A table shows the pounds of dry matter and digestible nutrients in 100 pounds proprietary foods. A discussion is included, concerning the functions performed by the various constituents. The digestibility of foods, nutritive ratio and fuel value are all explained. Tables giving the per cent. composition of the usual foods used in poultry feeding are also included, together with the method of compounding rations from the composition of the foods. The water, mineral, and lime supply for poultry are discussed, and the analysis of the wastes of the hen or hen-manure is given.

At the end is a chapter on the food inspection law, and a list of bulletins treating on poultry management to be had either from the various experiment stations or from the U. S. Department of Agriculture. J. A. LECLERC.

**Injury to Vegetation by Smelter Fumes.** BY J. K. HAYWOOD. *U. S. Dept. Agr. Bur. Chem., Bull. 89*, p. 23.—The results are given of an investigation undertaken to determine whether the fumes from a copper smelting plant, situated at Redding, Shasta Co., California, were injurious to vegetation, and if injurious, the extent of the area affected. The company operating the plant acknowledged injury to a limited area surrounding the plant, so the investigation was conducted in the territory beyond the limits of the area of acknowledged damage.

In experimental work outlined to show the injury to vegetation of fumes of sulphur dioxide, pine trees and cow-peas were treated in a fumigating chamber with air containing varying quantities of sulphur dioxide. A pine tree subjected to 25 one-hour fumigations with 1 part sulphur dioxide to 10,000 parts of air, and then eighteen fumigations with 1 part sulphur dioxide to 30,000 parts of air, was badly injured, while with more concentrated fumes the injury was accomplished in much shorter time. Cow-peas, after three one-hour fumigations with 1 part sulphur dioxide to 10,000 parts of air, were so badly injured that they could not be revived. Analyses of the treated plants and untreated plants showed a much higher content of sulphur trioxide in the leaves and the ash of the former, than of the latter.

An examination of the foliage from injured and uninjured vegetation in the vicinity of the copper smelter, showed that in 80 per cent. of the cases investigated, the sulphur trioxide content of the leaves of the injured vegetation was higher than that of the uninjured; it was also shown that 80 per cent. of the injured trees

contained a larger percentage of sulphur trioxide in the ash than the uninjured trees. This higher content of sulphur trioxide in the injured trees is attributed to the absorption of sulphur dioxide from the air.

Analyses of needles from Eastern pines, and from western pines grown in the vicinity of the smelter at Redding, California, showed that the needles from eastern pines have a much lower sulphur trioxide content than even the needles from uninjured western pines, although the soil in both cases contained practically the same amount of sulphur trioxide.

In the author's opinion, the investigation shows that—(1) Sulphur dioxide when present in very small quantities in the air kills vegetation; (2) such injury shows itself in the increased sulphur trioxide content of the foliage, and (3) the vegetation around the smelter for at least 3½ miles north, 9 miles south, 2½ miles east, and 5 to 6 miles west, has been greatly injured.

L. S. MUNSON.

**Analyses of Waters.** BY GEORGE E. COLBY. *22nd Report, Cal. Agr. Expt. Sta. (1903-4)*, p. 34.—One hundred and forty-four samples of waters, comprising lake and stream, spring and common well, artesian well, and those from reservoirs and irrigation ditches, were examined during the year to determine their fitness for domestic and irrigation purposes. A water containing 10 to 18 grains of carbonate of soda or common salt, or 75 to 100 grains of sodium sulphate per gallon is considered "doubtful for permanent irrigation," while an amount higher than 18 grains renders the water "unsuitable for irrigation." For ordinary drinking purposes the presence of about 40 grains of soluble salts (sulphides chlorides, and carbonates) per gallon is usually regarded as beyond the endurance of the systems of most persons.

The following table gives the classification of the waters examined:

| Source. | No. examined. | Suitable for use. | Of doubtful use. | Not suitable for domestic or irrigation purposes. |
|---|---|---|---|---|
| Lakes and streams...... | 12 | 9 | .. | 3 |
| Springs................ | 41 | 23 | 4 | 14 |
| Common wells.......... | 82 | 37 | 6 | 39 |
| Artesian wells.......... | 9 | 7 | .. | 2 |
| Totals........... | 144 | 76 | 10 | 58 |

L. S. MUNSON.

**Examination of Paris Green and Other Arsenicals Used in Spraying.** BY GEORGE E. COLBY. *22nd Report, Cal. Expt. Sta. (1903-4)*, p. 44.—65 samples of Paris green were examined during the year, of which 30, coming under the State law, were dealers'

samples, representing 59,113 pounds, and 35 were orchardists' samples. Of the dealers' samples all contained over 50 per cent. (the minimum allowable) of total arsenious oxide and only 4 samples, representing 3,336 pounds, contained more than the allowable 4 per cent. of soluble arsenious oxide. The results of the examination show that the quality of Paris green now offered for sale in California is very greatly improved over that formerly sent out, and that the law governing the sale of Paris green is efficient in protecting the purchasers of this article from the injurious results arising from inferior goods. L. S. MUNSON.

**Experiments on the Digestibility of Cereal Breakfast Foods.** BY W. O. ATWATER. *Conn.* (*Storrs*) *Agr. Expt. Sta. Rep.*, *1904*, pp. 180-209.—A report of investigations conducted by H. C. Sherman and R. D. Milner. Nine natural digestion experiments were made, with 5 subjects. Three kinds of breakfast cereal were used, two of which were of the same general character, while the third was somewhat different. All three proved to be similar in chemical composition, and the digestibility of their nutrients agreed very closely. Averaging all the experiments, the digestibility of the protein was 71 per cent. (though applying a suggested correction it would be about 74 per cent.), and that of carbohydrates 90 per cent. Owing to the very small quantity of fat in the cereal, the digestibility of fat could not be determined. In respect to the proportions of the nutrients digested the breakfast foods agreed with graham flour, but were inferior to white flour.

R. D. MILNER.

**Nutrition Investigations.** BY M. E. JAFFA. *22nd Rep. Cal. Agr. Expt. Sta.* (*1904*), pp. 53-70.—A resumé of the investigations on the nutrition of man conducted by the author at the California Agricultural Experiment Station, during the years 1896-1902: compiled from U. S. Department of Agriculture, Office of Experiment Stations Bulls. Nos. 84, 107 and 132 (see this Journal, 1900, R. 166, and 1904, R. 130). R. D. MILNER.

**The Nutritive Value of Cereal Breakfast Foods.** BY R. D. MILNER. *Conn.* (*Storrs*) *Agr. Expt. Sta. Rep.*, *1904*, pp. 210-240.—A popular article summarizing the knowledge that has been obtained at the agricultural experiment stations and elsewhere, regarding the origin of the breakfast food, the methods of preparing different sorts, and the composition, digestibility and relative pecuniary economy of a large number of common brands.

R. D. MILNER.

## PATENTS.

[A copy of any patent will be sent to any one who sends five cents, with the number, name of the patentee, and subject of the invention to the Patent Office.]

SEPTEMBER 6, 1904.

769,289. Alexander P. Anderson, Bedford Park, N. Y. **Adhesive.** A dry spongy lump of pure starch with disrupted granules, having a protective glaze, but easily soluble in water at ordinary temperatures. Made by heating starch in sealed tubes and breaking the tubes while hot.

769,305. Emile Davines, Sierra Madre, Cal. **Soap.** Dissolve potassium hydroxide in water 4 to 100, add vegetable oil 8, and animal fat 40, then boil with cocoa butter and petrolatum 4 each and finally add 1 part nitric acid.

769,355. Carl Platow, Lehe, Germany. **Fire-proof flooring.** Magnesia and a wood filler, as sawdust, are made into a paste by solution of magnesium chloride, Portland cement added and the whole dried, then moistened with magnesium chloride and heated on the floor.

769,467. Frederick W. Brown, Portland, Colo. **Hydraulic cement.** Argillaceous and calcareous materials are fused with calcium sulphate to a high heat in an oxidizing furnace.

769,474. Wm. F. Fruehauf, New York, N. Y. **Thermometer.** This thermometer has a tube, a bulb and a hollow closed core within said bulb.

769,522. John M. Williams, Guthrie, Okla. Treating **flour.** Water is electrolyzed and the gases immediately forced through the flour whereby it is whitened and purified.

769,531. Ewald Bremer, Martupol, Russia. Oven for **coking peat.** A vertical, cylindrical jacketted oven has drying receptacles on top, around which the waste gases are burned and the fresh supply of peat dried, before letting down into the coking oven.

769,534. Albert E. Cummer, Cleveland, Ohio. **Calcining aluminium sulphate.** The powdered material is heated to 180° F., partially drying it, and the temperature is then raised till 300° F. is reached.

769,541 Herman Greeder, Scio, Ohio. **Cleaning and waxing pad.** Absorbent paper is saturated with a mixture of wax, eucalyptus oil and formaldehyde, and enclosed in a fabric casing that is saturated with sodium tungstate.

769,585. Henry S. Blackmore, Mt. Vernon, N. Y. **Sulphuric anhydride.** A conduit is provided with a series of wire gauze diaphragms to be heated by electricity, and having steam and air supply together with sulphur dioxide, said conduit leading into a collecting chamber which is jacketted, and the various gases

being maintained at a suitable temperature while passing through the conduit.

769,593. Louis Descamps, Lille, France. **Hydrosulphite formaldehyde.** These substances react to form colorless crystals, which do not reduce indigo sulphonic acid at ordinary temperatures, but do reduce it at 40° C.

769,681. Albert C. Calkins, Los Angeles, Cal. Assignor one-half to Henry C. Brett, same place. **Treating oils.** The oil is treated with sulphuric acid in a closed tank. Then sulphurous gas generated in the reaction is used to bleach the oil.

SEPTEMBER 13, 1904.

769,737. Horace C. Gardner, Chicago, Ill. Processing **canned goods.** The cans are moved through a bath of molten paraffin.

769,773. Wm. G. South, Berwyn, Pa. **Color photography.** A red image is printed and developed on a red pigmented bichromatized hygroscopic glue, a blue and yellow image of the same object are printed in registry on transparent films that develop blue and yellow respectively.

769,774. Hermann H. Spohn, Boston, Mass. **Ink.** A water-soluble basic aniline color is combined with an acid soap heated to 150° F., cooled to 120° F. and kerosene added.

769,860. Willard O. Felt, New York, N. Y. **Purifying gas.** The gas is first cooled, then scrubbed, then brought in contact with glycerol and finally with oxide of iron in spongy form.

769,938. Henry R. Cassell, New York, N. Y. **Extracting precious metals.** Solutions of a bromide and a cyanide are added to the ore, and chlorine gas then passed through the mixture, which liberates bromine and dissolves the metals.

769,954. Armand Muller-Jacobs, Richmond Hill, N. Y. **Mordanting.** A compound containing stearamide is used as a mordant.

770,030. Jean A. Trillat, Paris, France. **Roquefort cheese.** Assigned to Société des Caves, Roquefort, France. The milk is sown, prior to the curdling thereof, with moldy bread from which the fat has been previously extracted.

770,046–7. Hans von Dahmen, Vienna, Austria-Hungary. Assignor to G. Roth, same place. **Explosive.** Ammonium nitrate 65, aluminum 23, and nitrotoluene 10, carbon 2 per cent. No. 2 is for compressing the first two ingredients, and heating and immersing the mass in a molten bath of the hydrocarbon.

770,082. Heinrich Linnekogel, Feuerbach, Germany. **Plastic floor covering.** Dry casein is mixed with crushed gallnuts and a pigment, water added to form a paste which is mixed with fiber, and after drying a coating of glycerol and resin is given.

770,083. Eugene C. May, Chicago, Ill. **Fire-proof bricks.** Ashes 5, and powdered silica and lime one each, are mixed with water, molded under pressure and dried, then coated with a compound of carborundum, calcium chloride and sodium silicate.

770,137. Henry F. Williams, San Francisco, Cal. **Paving composition.** A lime sludge, which is calcium carbonate from the purification of beet-sugar, 10 parts, is mixed with hot bituminous sand rock, 90 parts.

770,177. Paul Julius, Hans Reidel and Fritz C. Gunther, Ludwigshafen on Rhine, Germany. Assignors to Badische Anilin und Soda Fabrik, same place. **Azo dye.** Sodium carbonate and a hypochlorite react on diazotized naphthylamine-*o*-sulpho acid and the *o*-hydroxy diazo compound is combined with $\beta$-naphthol to form a free acid of the formula $C_{10}H_4(SO_3H)(OH)—N—N—C_{10}H_6$ (OH), which gives a blue solution in dilute sodium carbonate and strong sulphuric acid, and reddish violet in dilute caustic soda, dyeing dark red violet, that on chroming becomes blue-black.

770,187. Giovanni B. Raffetto, New York, N. Y. **Preserving marrons.** The shelled kernels have their pericarps removed by hot water, they are wrapped in paper and cloth and boiled, then dipped in syrup and cooled.

770,202. Carl H. Voigt, Leipzig-Plagwitz, Germany. Assignor to Louise Voigt, same place. **Glue substitute.** Starch 10, mucilage, water 30 to 50, and from 4 to 6 per cent. of a mixture of barium or strontium peroxide and alkaline sulphate at 100° to 200° C. and under pressure.

770,214. Henry S. Blackmore, Mt. Vernon, N. Y. Making **hydrogen carbide.** A metallic carbide containing at least 9 per cent. of carbon is acted on by a sulphur petroleum, as Lima oil.

SEPTEMBER 20, 1904.

770,275. Herman Endemann, New York, N. Y. **Antiseptic compound.** Rosin size is made from rosin and caustic alkali, and oxidized by permanganic acid. It is soluble in hot water and alcohol, partially soluble in benzene and chloroform, having a bitter taste and melting between 105° and 125° F.

770,280. Frederick J. Hoyt, Chicago, Ill. **Amalgamating machine.** A cylindrical vessel has a feed pipe, strainer and funnel on top, the latter with a bent delivery pipe through which the material is charged onto a globe revolving in a mercury-bath which delivers through the bottom of the cylinder into a conducting trough.

770,356. Moses P. Davies and Edward Wilding, London, England. **Yeast.** Powdered yeast 75, potato meal 20, malt flour 4, and tartaric acid ½ to ¼ part.

770,389. Walter Rubel, Berlin, Germany. Assignor to Nathan Bernstein, same place. **Aluminum.** Clay 400, calcium phosphate

70, sulphuric acid 60, lime 200, and mineral oil 60 parts, are heated to a cherry red, the reaction being $2Al_2S_3 + 3C = 4Al + 3CS_2$.

770,428. Edward J. Griffiths, Los Angeles, Cal. Assignor to George Griffiths, same place. **Smudge compound.** Crude petroleum 24, sawdust 33, coal screenings 23, asphalt containing sulphuric acid 20 parts.

770,430. Wm. Herzberg and Otto Siebert. Assignors to Actien Gesellschaft for Anilin Fabrication. **Red lake.** The diazo compound of *p*-amino phenolalkyl ether *m*-sulphonic acid unites with β-naphthol to form a brilliant red lake with a suitable base, said lake being insoluble in water, alcohol, oils and fats, becoming red-violet in concentrated sulphuric acid.

770,463. Wm. Hoskins, Lagrange, Ill. Treating **wood.** The wood is first distilled by steam at a temperature which does not injure the fiber for paper, and then it is digested with soda for paper pulp.

770,503. Eli H. Larkin, St. Louis, Mo. **Coal briquettes.** Coal slack 97, petroleum 3, and to 100 parts of this mixture is added 2 pounds of starch paste; the whole is then molded into forms.

770,533-4. Wilhelm Ostwald and Oscar Gros, Leipzig, Germany. **Reproducing pictures.** Catalyzing agents like hydrogen peroxide are applied to a platinum print, pressed against a gelatin surface and the whole immersed in ammonium ferrous sulphate to make a relievo used for printing. In the second the hydrogen peroxide image is treated with a solution of a manganese salt, ammonia and ammonium chloride.

770,554. Alfred Bougault, Paris, France. Assignor to Société Française de Construction Mécaniques. **Illuminating gas.** Producer gas is mixed with air and forced into the body of incandescent fuel at the base thereof.

770,557. Courtland W. Brunson, Hamilton, Ohio. **Artificial stone.** Barytes 1, cement 4, lime 6, sand 30, and cinders 70 parts.

770,636. Karl Geiser and Hans Kehrli, Berne, Switzerland. **Inking cylinder.** Starch is mixed with a concentrated solution of magnesium chloride and 2 per cent. of glue and glycerol.

770, 643. Ernst Klie, Charlottenburg, Germany. Assignor to Fabrik, Dr. Alb. R. W. Brand u. Co., same place. **Coloring natural stones.** Marble, etc., is dried and put in a hot solution of a metallic oleate, turpentine and acetic acid.

770, 658. David Sandmann, Berlin, and George Eichelbaum, Charlottenburg, Germany. **Preserving fruit juices.** Hydrofluoric acid is added, the precipitate removed, an alkaline earth compound added, and the juices filtered off from the precipitate.

770,675. Ludwig Champowich, New Britain, Conn. **Cement.**

Rosin 10, black lead 6, sand 5, with iron scale to fasten shanks in door-knobs.

770,700. Moritz Roeseler, Berlin, Germany, and August Schaer, Holland, Mich. **Beet-sugar.** The centrifugal overflow from sugar granulated by alkaline salts is treated by osmosis, then with phosphoric acid, then with alkaline earth oxide and carbon dioxide or sulphur dioxide, and the product is mixed with fresh beet juice to concentrate in the vacuum pan to granulated sugar.

770,730. Louis Emile Muller, Paris, France. **Carborundo cement.** Silicide of carbon 30, refractory clay 30, sodium silicate 30, and lime 2.

SEPTEMBER 27, 1904.

770,743. Emil Fischer, Berlin, Germany. Assignor to E. Merck, Darmstadt, Germany. **Dialkyl barbituric acid.** Diethyl malonyl chloride is heated with urea, and the resulting acid purified.

770,883. George S. Yingling, Tiffin, Ohio. **Tobacco compound.** Vinegar and rain water 100 each, valerian root and cascarilla bark 2 each, tannic acid and gallic acid 1 part each.

770,905. Levi Hornor, Wichita, Kan. **Blackboard compound.** Plaster of Paris 1, lampblack 2, Portland cement 3 parts, with sufficient water.

770,909. Samuel R. Kennedy, Philadelphia, Pa. **Condensing milk.** The cream is removed from milk, the latter condensed and mixed with the cream, and sprayed through a high vacuum.

770,940. Karl Stephan and Paul Hunsalz, Berlin, Germany. Assignors to E. Schering, same place. **Camphor.** Isoborneol is oxidized by aqueous permanganate, and the camphor separated.

770,963. Wm. D. Gilman, Sweetwater, Tenn. **Bleaching barytes and recovering Glauber salt.** Ground barytes is mixed with a hot solution of niter cake, the solution drawn off and the ore washed with hot water, the solution and washings mixed, the impurities precipitated by soda, leaving Glauber salt in solution, which is concentrated and crystallized.

770,976. Nestor Lopez, Delrio, Texas. **Boiler cleaning compound.** Extract of *Covillea divaricata*, *Phargmites phragmites* and *Yucca* are mixed.

770,991. August Voelker, Berlin, Germany. Assignor to Société Anonyme Verriere, Bruxelles. **Incandescent electric material.** Carbon is granulated and the grains sized from 1 to 7 mm., and the conductivity of each size adjusted by adding graphite or a silicate.

WM. H. SEAMAN.

# REVIEW OF AMERICAN CHEMICAL RESEARCH.

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WILLIAM A. NOYES, Editor.



## GENERAL AND PHYSICAL CHEMISTRY.

**Spectra of Gases at High Temperatures.** BY JOHN TROWBRIDGE. *Am. J. Sci.*, 18, 420–426, 1904.—This paper describes a continuation of previous work on discharges of a storage battery of 20,000 cells, used to charge large condensers. The voltages obtained varied from 100,000 to 3,000,000.

Using hydrogen the spectrum in the capillary was nearly continuous, the "four line" spectrum appearing strongly in the wider portions of the tube. The combination of the gas with the metal of the electrodes is shown by the diminution of the pressure in the tube during discharge. This removal of gas is especially noticeable in the case of copper electrodes.

Of especial interest is the device used to show the reversal of the hydrogen C-line in a Geissler tube. The light from the capillary passed through the light produced by a spark gap inside the tube. The pressure in the tube was such that both luminescences were continuous and the C-line was seen perfectly reversed.

Evidence is offered that a certain amount of water vapor is a necessity for conduction in gases, and that dissociation or a chemical reaction of some kind is an invariable accompaniment of the appearance of a spectrum. H. W. MORSE.

**Spectra of Gases and Metals at High Temperatures.** BY JOHN TROWBRIDGE. *Proc. Am. Acad.*, 38, 681–688, 1903; *Phil. Mag.*, 6, 58–63, 1903.—A continuation of the author's experiments on the discharge of strong currents through gases in narrow capillaries is described. The facts obtained are regarded by the autho as evidence that spectra are definitely connected with, and dependent upon, chemical reactions, such as oxidation and hydration. Especially in the case of silicon doubt is raised that

the lines of the spectrum are really due to the metal, rather than to a reaction between the element and the gases present.

The spectrum produced by discharges between calcium electrodes shows all the lines usually ascribed to that metal, while the spectrum between electrodes of other metals shows some of the strong calcium lines (from the glass), while other strong lines are entirely absent. Phenomena of reversal are also considered.

H. W. MORSE.

**On the Analysis of Bright Spectrum Lines.** BY JAMES BARNES. *Phil. Mag.*, **7**, 485–503, 1904; *Astrophys J.*, **19**, 190–211, 1904.—The strong lines of mercury, cadmium, thallium, and the red line of hydrogen have been analyzed by a method similar to the now well-known one of Fabry and Perot, and photographs of the interference fringes illustrate the paper. The effect of varying the conditions under which the spectra are produced is discussed. It may certainly be said, with the author, that the agreement in the results of investigations on the components of complex spectrum lines is not satisfactory, and it should be especially noted that the effect of conditions, such as temperature, pressure, strength of current and density of the luminescent vapor, offer problems which are still far from a satisfactory solution.

H. W. MORSE.

**On a Possible Variation of the Solar Radiation and Its Probable Effect on Terrestrial Temperatures.** BY S. P. LANGLEY. *Phil. Mag.*, **8**, 78–91, 1904.—The results of a long series of determinations of the Solar Constant show a probable diminution of about 10 per cent., beginning at the close of March, 1903. The observed temperatures of 89 stations distributed over the North Temperate Zone show a corresponding decrease of about 2° C., compared with the average of many previous years. (These results should be of importance in photochemical researches which depend on the constancy of solar radiation, and will become of greater importance as greater accuracy is attained in such work. At the present time the accuracy of measurement of light reactions has hardly reached a point where variations of 10 per cent. would come into consideration.)

H. W. MORSE.

**Some Additions to the Arc Spectra of the Alkali Metals.** BY F. A. SAUNDERS. *Proc. Am. Acad.*, **40**, 439–453, 1904.—By the use of a mounting method which eliminates to a large degree the usual astigmatism of the concave grating, some new lines have been added to the spectra of the alkali metals. These lines are faint, and so diffuse that they are probably not due to impurities. Serious relations have been determined, and form an extension to the work of Lenard on these same arc spectra. No simple formulae have been found which fit these series.

H. W. MORSE.

**A Quantitative Determination of the Anomalous Dispersion of Sodium Vapor in the Visible and Ultra-violet Regions.** By R. W. Wood. *Proc. Am. Acad.*, 40, 365–396, 1904.—An interferometer method similar to those of Michelson and Brace is applied to the determination of the dispersion and refractive indices of sodium vapor, especial attention being paid to the region in the vicinity of the D-lines. The yellow helium line is used as a basis for the measurement of the fringe-displacement, and the accuracy attained is far beyond that of all previous investigations. The refractive index is found to change from 0.9954 at $\lambda$ 5875 to 0.6970 at $\lambda$ 5889.6. The original should be consulted for results of measurement and comparison with the theoretical formula.

H. W. Morse.

**Spectra from the Wehnelt Interrupter.** By Harry W. Morse. *Proc. Am. Acad.*, 39, 519–544, 1904; *Astrophys. J.*, 19, 162–186, 1904.—Spectra of a number of metals in an arrangement similar to the electrolytic interrupter of Wehnelt are discussed, the metal being used sometimes as active electrode, and sometimes in solution. The active point in the latter case is of platinum or carbon. The only gaseous line observed was the red line of hydrogen. The spectra are in some respects like those of the arc, in others like spark spectra. Lines usually ascribed to flame spectra also appear, and the "oxide bands" of several metals are strong. It seems probable that the point and the region around it pass through the entire series of temperatures, from that of water below its boiling-point to that necessary for the vaporization of platinum, at each interruption of the circuit, and that the resulting spectra are composites of spectra belonging to all of these temperatures.

H. W. Morse.

**The Influence of Atmospheres of Nitrogen and Hydrogen on the Arc Spectra of Iron, Zinc, Magnesium, and Tin, Compared with the Influence of an Atmosphere of Ammonia.** By Royal A. Porter. *Proc. Am. Acad.*, 38, 374–379, 1902.—A continuation of the investigations of Liveing and Dewar, Crew, Basquin, King, and others on the effect of various atmospheres on arc spectra is described.

The conclusion of greatest importance is stated as follows by the author: "The readiness of an atmosphere to form chemical union with the electrodes under ordinary conditions is a very small, probably insignificant, factor in determining the intensity of the arc. The intensity appears to be due to electrical causes rather than to chemical reactions." A change of resistance, due to the products of the arc, may explain certain of the phenomena, but the fundamental explanation of the effect of external conditions on the lines of a spectrum seems as far away as ever.

H. W. Morse.

**The Anomalous Dispersion, Absorption, and Surface Color of Nitroso-dimethyl-aniline.** BY R. W. WOOD. *Proc. Am. Acad.*, 39, 51–66, 1903; *Phil. Mag.*, 6, 96–112.—Data on the optical properties of this substance in the solid, liquid and gaseous states, including the refractive index for a part of the spectrum, and the results of measurements of the reflecting power from $\lambda$ 2170 to $\lambda$ 5700. Of more general interest are the results reported in other investigations on the same substance (see *Phil. Mag.*, 5, 257, and *Phys. Ztschr.*, 4, 337). H. W. MORSE.

**Oudemans' Law and the Influence of Dilution on the Molecular Rotation of Mandelic Acid and Its Salts.** BY J. WALLACE WALKER. *Trans. Roy. Soc. Canada*, 8, III, 113–116, 1902.—Mandelic acid has a molecular rotation of about 243° and is suitable for measurements to considerable dilutions. The results obtained agree in the main with the dilution law of Ostwald, but marked deviations appear, and the degree of dissociation, as measured by the rotation, is much greater than that calculated from the conductivity measurements. There are also indications that in all of the salts, except those of calcium, the molecular rotation, after falling to a minimum as dilution increases, begins to increase again. This result is confirmed by the measurements of Rimbach (*Z. physik. Chem.*, 28, 253). H. W. MORSE.

**1. Note on Thermodynamic Surfaces. 2. The Slope of the Vaporization Neutral Curve.** BY J. E. TREVOR. *J. Phys. Chem.*, 8, 83–91, 341–350.—**1. On the Stability of the Equilibrium of a Homogeneous Phase. 2. On the Stability of the Equilibrium of Bivariant Systems. 3. On the Stability of the Equilibrium of Multivariant Systems. 4. On Indifferent Points.** BY PAUL SAUREL. *J. Phys. Chem.*, 8, 325-334, 436–439, 488-490, 491-492.

These are purely mathematical articles dealing with various forms of physico-chemical equilibrium. A. A. NOYES.

**Action of Sodium and Potassium Amalgams on Various Aqueous Solutions.** BY GUSTAV FERNEKES *J. Phys. Chem.*, 7, 611-639.—The author has measured the rate of decomposition of solutions of a number of salts and also of organic non-conducting substances by sodium or potassium amalgam. The former contained in 5 cc. 0.0472 gram sodium. The rate of decomposition was measured by the volume of gas evolved. The salts, on the solutions of which sodium amalgam acts faster than on water are: $Na_2AlO_2$, $NaHCO_3$, $Na_2HPO_4$, $Na_2SO_3$ and NaOH. The salts: NaBr, $Na_2B_4O_7$, $Na_2SO_4$, NaCl, $Na_4P_2O_7$, NaI, $NaC_2H_3O_2$ have the opposite effect, also pure NaOH, prepared from metallic sodium. The influence of concentration is not very pronounced. The different potassium salts have a very similar effect. Of other salts calcium chloride is the most effective. The behavior of

different salt solutions towards potassium amalgam is very similar to that of sodium and potassium salts towards sodium amalgam.

The widely different behavior of sodium hydroxide prepared from metallic sodium and that purified by alcohol can hardly be explained by the chemical composition. The former contained as impurity only a trace of iron, while the specimen purified by alcohol contained 1.75 per cent. $Al_2O_3$, 0.26 per cent. CaO, and traces of $SO_2$ and Cl. However, by the addition of various known impurities to the purest sodium hydroxide the increase observed with the alcohol-purified sample could not be obtained.

Besides these salts a large number of organic compounds (hydroquinone, alcohols, ketones, amines, and others) were investigated. These compounds caused a more or less marked increase of the rate of reaction between amalgam and water, glycerol, ether, methyl alcohol and thymol showing the most marked effect. Propyl alcohol, on the contrary, produced a very marked decrease of the reaction velocity.

The author discusses the results obtained with salts from the standpoint of the dissociation-theory, of which the decreasing effect of sodium salts is an obvious consequence, while it would be expected that potassium salts have no retarding influence, provided that no other reaction comes into account. As the observed facts do not correspond to these theoretical requirements the author sees in this circumstance a new argument in favor of the view presented by Kahlenberg that this theory has outlived its usefulness. And further it is shown that several phenomena may be brought into accord with the affinity-theory of Kahlenberg, according to which the equal behavior, for instance, of sodium and potassium chloride towards sodium amalgam can be explained, if it is assumed that potassium chloride has about the same affinity for water as has sodium chloride.

As the above results might possibly be considered a valid argument against the theory of Arrhenius, the reviewer wishes to object to any such interpretation, and to state that at any rate a theory which correlates quantitatively a number of apparently disconnected phenomena is of more value than a hypothesis which affords only explanations founded upon assumptions and not on numerical data. While it is doubtless of great value to show unhesitatingly the limits and weaknesses of the theory of Arrhenius, it is unscientific to replace this theory, which has been proved to be useful in many respects, by qualitative considerations. It may further be mentioned that the author has overlooked the fact that the different behavior of the commercial and pure hydroxide of alkali metals has already been observed and measured by W. Kerp (*Z. anorg. Chem.*, 17, 284). W. BÖTTGER.

**The Action of Sodium Amalgam on Solutions of Potassium Salts and of Potassium-Amalgam on Solutions of Sodium Salts.** BY G. MCP. SMITH. *J. Phys. Chem.*, 8, 208–213.—This

paper deals with the investigation carried out by G. Fernekes (see preceding abstract). The author suggests the view that the slow action of potassium salts on sodium amalgam might be due to the intermediate formation of potassium amalgam and conversely the retarding effect of sodium salts on potassium amalgam to the formation of sodium amalgam. As it was shown by experiment that from a 1 per cent. potassium amalgam and a saturated solution of sodium chloride after thirty minutes 0.83 gram potassium out of 1.1 grams present were replaced by sodium, this argument for the theory of Kahlenberg (see Fernekes) seems to be unwarranted. W. BÖTTGER.

**Action of Amalgams upon Solutions** (Reply to G. McP. Smith). BY GUSTAVE FERNEKES. *J. Phys. Chem.*, **8**, 566–570.—Of the facts which are dealt with in this paper it may be mentioned that barium amalgam (containing 0.5724 gram barium in 50 grams) does not form sodium or potassium amalgam if allowed to act on a concentrated solution of one of the salts (chloride or sulphate) of these metals during four to five hours. And yet these salts decrease markedly the rate of reaction between barium amalgam and water.

It is further shown that sodium amalgam after treating with a solution of equimolecular quantities of sodium and potassium chlorides is transformed into potassium amalgam, while potassium amalgam, under the same conditions, does not give sodium amalgam. This, furthermore, is in full accordance with the thermochemical data. In view of these facts and the fact that Smith does not explain the anomalous behavior of sodium hydroxide solutions towards sodium and potassium amalgams and also does not explain the behavior of the organic compounds the author thinks that the theory of Kahlenberg is justified and also that the ionic theory is of limited applicability. While this is undoubtedly true in the sense that the ionic theory cannot explain and should not be expected to explain all the phenomena of solutions, and especially all those of reaction velocity in which electrolytes are involved, it is nevertheless unjustifiable to regard this fact as an argument against the dissociation hypothesis. The theory of Kahlenberg itself does not, in a strict sense, apply to reaction velocities, but only to equilibria. The general statement given in the review of the first paper of the author may, therefore, be maintained. W. BÖTTGER.

**On the Weston Cell.** BY H. T. BARNES AND L. B. LUCAS. *J. Phys. Chem.*, **8**, 196–207.—This investigation is devoted to the explanation of the fact that the changes of electromotive force per degree, observed in the laboratorv of McGill University, were higher than those which correspond to the formula proposed by Jaeger and Wachsmuth. The result is that the divergence is due to the strength of the cadmium sulphate solution. From the

experiments carried out between 14.6° and 28° with all due precautions, it follows that cells with a solution of cadmium sulphate saturated at 0°—th refore, unsaturated at ordinary temperatures (supplied by the Weston Electrical Instrument Co.)—have practically no temperature coefficient, and cells with a saturated solution of constant strength show a change of 0.00038 per cent. per degree. Cells with moist crystals and a 13 per cent. amalgam have a temperature change of 0.0055 per cent. per degree. Cells with moist crystals and a 14.7 per cent. amalgam show a temperature change of 0.008 per cent. per degree.

For the ratio of the Clark cell at 15° to the Weston cell at 20° the authors find the value 1.40666 in very good agreement with the value of this ratio obtained by the Reichsanstalt 1.40665. The deviation from the previous value 1.40658 is probably due to the fact that the values obtained for the "inverted" cells were a little too high. W. BÖTTGER.

**Decomposition Curves of Lithium Chloride in Alcohols and the Electro-deposition of Lithium.** BY HARRISON EASTMAN PATTEN AND WILLIAM ROY MOTT. *J. Phys. Chem.*, **8**, 153–195.—The solvents which have been investigated are water, ethyl, propyl, butyl, amyl, and allyl alcohols, glycerol and phenol. The current-potential curve for a water solution does not show any indication of the deposition of lithium. For a solution in ethyl alcohol a current density of 0.54 ampere per square centimeter is required to get out a trace of lithium in unalloyed state. In a propyl alcohol solution the deposition of lithium, marked by a decrease of the current due to an increase of polarization, is more distinct, and the experiments with butyl and amyl alcohols show that the latter gives the highest yield of lithium. Glycerol behaves like water, in that no polarization due to the decomposition of metallic lithium could be observed, while phenol seems to act like the alcohols.

The single potential calculated from the heat of formation of lithium chloride is calculated to be 2.44 volts, while the mean value of the direct experimental determination is 2.41 volts. The authors also discuss the influence of concentration of the solution, the acid radical of the salts used, the conductivity of the solution, current density, chemical composition of the cathode and possible alloying effect, also decomposition voltage, and rate of action of solvent or solution upon the metal.

W. BÖTTGER.

**The Aluminum-Tin Alloys.** BY E. S. SHEPHERD. *J. Phys. Chem.*, **8**, 233–247.—The author discusses in this article the work of Gautier, Campbell and Mathews, Guillet, Anderson and Leau, and emphasizes several weak points in the views concerning the nature of aluminum-tin-alloys, which gave rise to this study. In the first place, it is shown that there exists no maximum (due to

AlSn) in the freezing-point curve at 20 per cent. aluminum as was found by Campbell and Mathews. In order to decide whether the flatness of the freezing-point curve is to be ascribed to the possible formation of two liquid layers or not, the author investigated further the composition of the liquid alloys at the top and bottom with the result that no difference could be observed.

The existence of SnAl was also tested for by the method of Bancroft with negative result, but the existence of a solid solution was confirmed by this method. The specific-volume curve, which was determined over the whole range of composition, shows a deviation from a straight line. At 20 per cent. tin the expansion has its maximum, so that it is probable that the limiting concentration lies between 20 and 30 per cent. There are also no arguments for the compound $Al_4Sn_1$, indicated by Guillet.

The author suggests incidentally a notation for distinguishing a solid solution from a compound. For the case of a continuous series of solid solutions as with silver and gold he suggests the symbol (AgAu), while for the case of limited solubility of one metal in the other he suggests a form of symbol like Al (Sn 20 to 30 per cent.), which would apply, for instance, to the above case.

W. BÖTTGER.

**The Ternary System: Benzene, Acetic Acid, and Water.** BY A. T. LINCOLN. *J. Phys. Chem.*, **8**, 248–256.—The author has repeated the work of Waddell (*J. Phys. Chem.*, **3**, 233) and finds that this author selected an unsuitable indication in using the same degree of clouding as the point of equilibrium in this system. By taking special care in defining the point of equilibrium the author obtained results which show that the equilibrium in this system can be represented by an exponential formula. Between 25° and 35° the exponential factor is constant, as in the case of chemical reactions.

W. BÖTTGER.

**Crystallization in Three-Component Systems.** BY WILLIAM C. GEER. *J. Phys. Chem.*, **8**, 257–287.—In this paper the phenomenon of solidification of a system by crystallization is theoretically discussed, both for the case that a binary compound is formed and for that where it is not. Under the first case are considered the two possibilities that the compound is stable or unstable at its melting-point. The results, which cannot be discussed briefly without graphical illustration, are applied to the systems: $CuCl_2.KCl.H_2O$, $MgSO_4.K_2SO_4.H_2O$, $FeCl_3.HCl.H_2O$ and Au.Sn.Cd. New data are not given.

The reviewer expresses the hope that the letters used in the text and in the figures will in future be more carefully compared. This would much facilitate the reading of papers of this kind.

W. BÖTTGER.

**Studies in Vapour Composition. III. Saturation by the Method of Air-bubbling.** By H. R. Carveth and R. E. Fowler. *J. Phys. Chem.*, 8, 313–324.—The result of this investigation, which is only a preliminary one, is that consistent results by this method can be obtained only with the greatest care, even with a liquid not changing in concentration. The errors observed are probably due to the formation of supersaturated conditions which are not readily brought back to equilibrium by the presence of an excess of the other phase.

Until a further study of the conditions of the applicability of this method has been made, any results obtained by it should be viewed with suspicion. W. Böttger.

**Calcium Sulphate in Aqueous Solutions of Potassium and Sodium Sulphates.** By F. K. Cameron and J. F. Breazeale. *J. Phys. Chem.*, 8, 335–340.—From the graphical representation of the results it can be seen that at a certain concentration of potassium sulphate a new solid phase is formed. This is, according to van't Hoff and Wilson, the compound syngenite. At 25° and a concentration of 32.47 grams potassium sulphate and 1.582 grams calcium sulphate per liter both gypsum and syngenite are in equilibrium with the solution. Further determinations were made of the solubility of syngenite in solutions of potassium sulphate of higher concentrations and also of the solubility of gypsum in solutions of sodium sulphate. The latter curve shows at first a decrease of solubility and later a regular increase until the solution is likewise saturated with respect to sodium sulphate decahydrate. W. Böttger.

**A Mechanical Model to Illustrate the Gas-laws.** By Frank B. Kenrick. *J. Phys. Chem.*, 8, 351–356.—The author describes a model which has been applied with success by students. By its means one may not only illustrate the simple gas equation $pv = nRT$, but also the more complicated one for adiabatic changes. Moreover, Carnot's cycle may be carried out, as is shown by a numerical example. As a full description would take too much space the reviewer contents himself with calling the attention of all those who are interested in the teaching of theoretical chemistry to this useful model. W. Böttger.

**Molecular Attraction.** By J. E. Mills. *J. Phys. Chem.*, 8, 383-415.—The author presents in this paper further (this Rev., 2, 107) evidence to show that the law of gravitation holds not only between masses, but also between the molecules of a substance and that this law is alone sufficient to account for the phenomena of the internal heat of vaporization. The equation $\frac{L - E_1}{\sqrt[3]{d} - \sqrt[3]{D}} = \text{constant}$, for any particular substance, where $L - E_1$ is the internal latent heat of vaporization and $d$ and D, the densi-

ties of liquid and vapor respectively at any particular temperature, is applied to the following substances: Ether, diisopropyl, diisobutyl, isopentane, normal pentane, normal hexane, normal heptane, normal octane, benzene, hexamethylene, fluorbenzene, chlorbenzene, brombenzene, iodobenzene, carbon tetrachloride, stannic chloride, water, methyl alcohol, ethyl alcohol, propyl alcohol and acetic acid. Excepting the values within 10° of the critical temperature the deviations from the mean value are, in most cases, within 2 per cent. In some cases in which the formula could even be tested up to within 1° of the critical temperature the divergence is not greater than 10 per cent. This and the deviations observed with diisobutyl, chlor-, brom- and iodobenzene and water are, according to the author, to be explained by errors of observation or multiplication of such errors in the calculation. Stannic chloride does not agree with the theory, but substances like water, methyl, ethyl, and propyl alcohols, and acetic acid which are associated, agree fairly well with it. This leads the author to the conclusion that the cause of molecular association in these substances must be the attraction which we are discussing and not some attraction such as we might denote by the term chemical affinity. There seems, however, at least in the case of water, to be a very marked deviation between 0°-30°, so that this statement does not, at least, seem applicable to all cases.

W. BÖTTGER.

**The Constitution of Copper-Zinc Alloys.** BY E. S. SHEPHERD. *J. Phys. Chem.*, 8, 421-35.—In this paper it is shown that there exist no "definite compounds" between copper and zinc, but six series of solid solutions, the limiting concentrations of which have been determined. There is given a scheme showing the conditions of existence of the different phases and a series of photomicrographs which show the effect of heat treatment on the brass. The reddish color of brass containing 61 to 43 per cent. copper is attributed to the β-crystals. For the annealing work the author used a very simple electric furnace, made by winding nickel wire about an ordinary porous cell. W. BÖTTGER.

**The Rate of the Reaction between Iodic and Hydriodic Acids.** BY SAUL DUSHMAN. *J. Phys. Chem.*, 8, 453-482.—It is shown that the rate of the reaction between the iodate ion, iodine ion and hydrogen ion is proportional to the first power of the concentration of the iodate ion, to the 1.85th to 2nd power of that of the iodine ion, and to the second power of the concentration of the hydrogen ion. In the presence of an excess of iodine the rate is proportional to the square of the concentration of the hydrogen ion, to the first power of that of the iodine ion and to the first power of that of the triiodine ion.

To explain these results the following schemes are suggested:

$$2HJ + JO_3^- = 2HOJ + JO^-$$

and

$$HJ + HJ_3 + JO_3^- = HJO + HJO_2 + JO^-$$

The former is in accordance with the work of Roebuck on the reaction between arsenious acid and hydrogen iodide. The substance $HJO_2$ is supposed to decompose straightway into $J_2$ and HJO.

A rise of temperature from 0° to 10° multiplies the rate by about 1.4. Light and potassium bichromate do not catalyze the reaction, and ferrous sulphate does so only moderately.

W. BÖTTGER.

**On the Deposition of Zinc from Zinc Chloride Dissolved in Acetone.** BY HARRISON EASTMAN PATTEN. *J. Phys. Chem.*, 8, 483-487.—The author finds a sharp bend in the decomposition curve corresponding to approximately 2 volts, when platinum electrodes were used. It is further shown that it is not commercially practicable to obtain chemically pure zinc by decomposition of a solution of zinc chloride in acetone. The solvent can, however, be used for continuous refining of metals which are readily attacked when used as anode. W. BÖTTGER.

**The Solubility of Calcium Sulphate in Solutions of Nitrates.** BY ATHERTON SEIDELL AND JOSEPH G. SMITH. *J. Phys. Chem.*, 8, 493–499.—The solubility of gypsum in a solution of sodium nitrate increases until 300 grams of the latter are present per liter. With potassium nitrate it is observed that the solubility steadily increases up to 200 grams per liter. For solutions of higher concentration, saturated with gypsum, irregularities are observed in that the quantities of calcium and sulphate do not agree, probably on account of the formation of a new solid phase. With magnesium nitrate the solubility steadily increases without passing through (though it does approach) a maximum value. Calcium nitrate diminishes the solubility steadily, according to the common ion effect. W. BÖTTGER.

**The Dissociation Points of Some Chlorides.** BY PETER FIREMAN AND E. G. PORTNER. *J. Phys. Chem.*, 8, 500–504.—The authors report the fact that a reddish brown precipitate forms on the surface of potassium or ammonium iodide when the latter is brought into contact with the fumes of antimony pentachloride. Evidence is given that this is due to the decomposition of the antimony pentachloride and not to any other reaction, for compounds like stannic chloride or titanium tetrachloride, the fumes of which are not appreciably dissociated, do not exhibit this phenomenon, while phosphorus pentachloride, chromic, ferric and cupric chlorides behave like antimonic chloride. The "disso-

ciation points," that is, the temperatures at which the first traces of chlorine could be detected by moist potassium iodide starch paper have been determined with the following results: Phosphorus pentachloride, 157-158°; ferric chloride, 122-123°; cupric chloride (anhydrous), 344°; chromic chloride (anhydrous), 355°. The dissociation point is fairly constant, being independent of the length of the test-tube in which the reaction is carried out. Antimony pentachloride acts at ordinary temperatures.

W. BÖTTGER.

**The Breaks in the Solubility Curves.** BY W. MEYERHOFFER. *J. Phys. Chem.*, 8, 571–575.—The author reports on two papers of Gay-Lussac, in order to show that this scientist did not recognize the relation between break in solubility curve and transformation of the solid phase, as is assumed and stated by Ostwald. The real explanation was given by Kopp in 1840; yet Gay-Lussac came very near making this discovery in 1839; and what Gay-Lussac failed to do Berzelius did in his Jahresbericht for 1841, not paying any attention, however, to the earlier formulation of the same idea by Kopp. W. BÖTTGER.

**The Electrical Conductivity of Solutions in Methyl Alcohol in the Neighborhood of Their Critical Points. I. and II.** BY CHARLES A. KRAUS. *Phys. Rev.*, 18, 40–56 and 89–103.—The chief aim of the investigation was to make a careful study of the conductivity of solutions in the immediate neighborhood of the critical point, as well as to determine the relation between the density of the solvent and the conductivity of the solution beyond the critical point. Methyl alcohol was selected as solvent for the reason that the conductivity of its solutions beyond the critical point is much greater than that of other solvents thus far studied. In some cases the conductivity of its solutions just beyond the critical point is as much as one-half that of the same solution at ordinary temperatures. It is to be remembered in this connection that the density of the solvent under these conditions is only about one-third of that at ordinary temperatures. Potassium iodide was employed as solute. Although this body reacts at higher temperatures to form a solution which is a much better conductor than it was originally, the action goes on rapidly to completion after which no further change takes place. Most other salts behave in the same way. The nature of the change has not been determined.

The maximum conductivity of methyl alcohol solutions lies in the neighborhood of 150°. When the tube contains such a quantity of solution that the meniscus disappears at the top of the tube it was found that a rapid change occurs in the temperature coefficient in the neighborhood of the critical point. At 0.2° below the critical point the temperature coefficient, which is negative, possesses a value of 50 per cent., while 0.1° above the critical

point the value is only 13 per cent. in terms of the conductivity at the critical point. A similar change takes place when a tube contains a quantity of solution such, that at the critical point the meniscus disappears in the lower part of the tube. In this case the contents of the tube were not mixed. The influence of diffusion, which is very slow at the critical point is to render the observed results less pronounced than they otherwise would be. It is to be noted that both below, as well as above, the critical interval the temperature coefficient is very nearly constant, compared to the changes which take place in this interval.

Curves are given which show the relation between the density of the solvent and the concentration of the solution at 5° and 10° above the critical point. It is very remarkable that the increase in conductivity, due to the addition of a given quantity of solvent, increases very rapidly with the density of the solvent. The addition of a quantity of solvent which produces a certain change in the conductivity at a density 0.127 produces approximately fifty times as great a change to a density 0.251.

The curves between conductivity and temperature vary considerably with the density of the solvent. At density 0.127 the curve is practically a straight line to density 0.20. The conductivity curve changes considerably just beyond the critical point, while at density 1.25 the curve is again much straighter. It is shown that the vapor contains considerable of the salt in solution at a temperature as much as 8° below the critical point. AUTHOR.

**The Specific Heats of Organic Liquids and Their Heats of Solution in Organic Solvents.** BY J. WALLACE WALKER AND JAMES HENDERSON. *Trans. Roy. Soc. Can.*, 8, Sec. III, 105–112. —The authors point out that hitherto the heat of solution has been studied chiefly in the case of electrolytes in water, where the phenomenon is complicated by ionic changes as well as by possible changes in the association of the solvent itself. They therefore carry out an investigation with bodies in which all disturbing factors are largely eliminated. It is shown that for the alcohols and some other associated liquids in water the heat of solution is positive and quite large, while that of non-associated organic compounds in benzene and toluene is negative and very small. The heats of solution of the alcohols among one another is positive, though very small, while that of the alcohols in benzene and toluene is negative and quite large. The results seem to indicate that the heat changes are a result of changes in the association of one of the liquids. It is pointed out, however, that this relation is not general. Thus acetone, though associated, gives no heat change on dissolving in acetic ether, while aniline, which is not associated, dissolves in benzene with absorption of considerable heat. Some other exceptions are mentioned. The authors determine the specific heats of a considerable number of com-

pounds and solutions which enables them to determine quantitatively their heats of solution. They determine thus the molecular heats of solution of methyl and ethyl alcohols in benzene, toluene, metaxylene, ethyl acetate and chlorbenzene. The heat of solution of methyl alcohol in the first three liquids is nearly the same, but differs greatly from that in chlorbenzene. The same holds true for ethyl alcohol whose heat of solution is greater than that of methyl alcohol. The heats of solution of ethyl alcohol are determined in benzene, toluene, nitrobenzene and phenetol over a considerable range of concentration. The values in benzene and toluene are not very different and approach each other somewhat with increasing dilution, but the values in nitrobenzene and phenetol are very different from each other, as well as from those in benzene and toluene. The authors conclude that it is not probable that the heat changes, observed in the solution of the alcohols, are due to dissociation of molecular aggregates.

C. A. KRAUS.

**The Fall of Potential Method as Applied to the Measurement of the Resistance of an Electrolyte in Motion.** *Trans. Roy. Soc. Can.*, 8, Sec. III, 135–140. **On the Resistance of a Hydrated Electrolyte and the Relation to the Density-Concentration Curve.** BY H. T. BARNES AND GUY W. JOHNSON. *Trans. Roy. Soc. Can.*, 9, Sec. III, 31–35.—In the first paper a study is made of the conductivity of magnesium chloride solutions with a view to determining if there is any relation between the irregularities in the concentration-density curve and the conductivity of the salt. A fall of potential method is applied in determining the resistance of the solutions for the details of which the original must be consulted. Two points of curvature occur in the concentration-density curve of magnesium chloride, although they are not very pronounced. While the conductivity-density curve exhibits irregularities approximately corresponding to those of the concentration-density curve, the evidence of a relation is not conclusive. In the second paper potassium chloride and potassium sulphate are investigated in the same manner and, although potassium sulphate gives a pronounced break in the concentration curve corresponding to two molecules of water, no irregularity whatsoever appears in the conductivity curve. Potassium chloride gives similar results and the authors conclude that the relation looked for does not exist.

C. A. KRAUS.

**On the Specific Heat of Water of Crystallization.** BY NEVIL NORTON EVANS. *Trans. Roy. Soc. Can.*, 8, Sec. III, 121–125.—In this paper the author elaborates an electrical method for determining the specific heat of solids with a view to determining the specific heat of water of crystallization, which is pointed out to be nearly that of ice in the case of many hydrated salts. The

apparatus has not been entirely perfected and a second communication is to follow. C. A. KRAUS.

**On the Absolute Value of the Mechanical Equivalent of Heat.** BY H. T. BARNES. *Trans. Roy. Soc. Can.*, **8**, Sec. III, 141-142.—The author compares briefly the values obtained for the mechanical equivalent of heat by different investigators and concludes that the most probable value is $4.1832 \times 10^7$ ergs, the 16° calorie (15.5° to 16.5°) being adopted as standard.

C. A. KRAUS.

**On the Cooper-Hewitt Mercury Interrupter.** BY GEORGE W. PIERCE. *Proc. Am. Acad.*, 39, 389–412. — The author makes a study of the mercury interrupter with a particular view to the cause of its efficiency. By means of the induction between two loops he finds that when a mercury interrupter is used to produce the oscillations the energy transmitted between the circuits is four times as great as when an iridium spark gap is used. This greater efficiency he ascribes to the more rapid recovery of the resistance in the mercury interrupter. By photographic means the author shows that "the accumulated effect of a number of discharges does not render the bulb conducting so as to weaken succeeding discharges." Herein lies the chief advantage of this interrupter over the spark-gap in air. From the photographs the author further shows that in the mercury interrupter the nature of the discharge is essentially the same as in the mercury arc except that in the case of the former the current suffers several rapid reversals. There is a faint glow over the anode surface and a bright point of light on the cathode. The resistance of one mercury interrupter was determined calorimetrically, and some applications of the interrupter are made to the study of resonating systems. C. A. KRAUS.

**On the Electrical Conductivity of Solutions in Sulphocyanates and Mustard Oils.** BY LOUIS KAHLENBERG. *Z. phys. Chem.*, **46**, 64–69.—The author investigates solutions in methyl-, ethyl-, and amyl-sulphocyanates, and in ethyl and allyl mustard oils. The solvent power of these compounds was found to be very restricted. The conductivity of trichloracetic acid was investigated in all of the above-named compounds, that of ferric chloride in the first four, that of silver nitrate in methyl and ethyl sulphocyanates, and that of mercuric chloride in ethyl- and amyl-sulphocyanate. The measurements were carried out in comparatively concentrated solutions, the dilution in most cases not exceeding 50 liters per mol. The limiting values of the equivalent conductivity were not determined. In general, the salts exhibit the same conductivity as they do in alcohol solutions. As in solutions in hydrocyanic acid the solutions of trichloracetic acid were found to be very poor conductors. Normal solutions of this acid

attack metallic magnesium and the carbonates of sodium and potassium, but not metallic zinc or calcium carbonate. A table of dielectric constants is given from which it may be seen that they are approximately the same as those of the alcohols.

C. A. KRAUS.

**Iron Salts in Voltameter Solutions.** BY J. M. BELL. *J. Phys. Chem.*, 7, 652–655.—According to Elbs the presence of the salt of a metal of variable valence in the solution of an oxyhydrogen coulometer should be avoided, since it decreases the amount of gas evolved far below the theoretical value. This action he ascribes to the expenditure of the oxygen and hydrogen in oxidizing and reducing the salt at the anode and cathode respectively. The author experimentally verifies these results indicated by Elbs, and further shows that when soluble electrodes are used in the coulometer only a slight reduction results in the efficiency on the addition of ferrous sulphate to the solution.

C. A. KRAUS.

**The Existence of Bodies Smaller than Atoms.** BY E. RUTHERFORD. *Trans. Roy. Soc. Can.*, 8, Sec. III., 79–86.—This is a paper, largely historical, setting forth the accumulated evidence for the existence of bodies smaller than atoms, and it gives clearly the main reasons for belief in the theory of electrons, which are briefly as follows: The cathode rays produced in a vacuum tube have been found to consist of a stream of negatively charged particles moving with extremely high velocity. By measuring the kinetic energy of these particles, the charge carried by them and the deflection of the path of the rays caused by a magnetic field, it was possible to calculate the ratio ($e/m$) of the charge ($e$) to the mass ($m$) of a single particle. This ratio was found to be approximately $10^7$. Now by applying Faraday's law of electrolysis it is readily shown that the ratio of the charge to the mass of a hydrogen ion in solution is approximately $10^4$. Hence, if the charge is the same in the two cases, the mass of the cathode ray particle must be 1/1000 that of the hydrogen atom. J. J. Thomson and Townsend then showed that the charge is actually the same. Thus the existence of this particle of sub-atomic size seems proved.

The same value of $e/m$ was found for ions produced by ultraviolet light at the surface of a metal, and also for those given off from a glowing carbon filament.

Furthermore, the observed effect of a magnetic field on the light emitted by a glowing body placed in the field, renders it possible to calculate the $e/m$ ratio for the vibrating particle which is, on probable assumptions, the cause of the light wave. This was found to be $10^7$, the same as in the three other cases.

Lastly, the same ratio has been found for the $\beta$-particles given off from radium.

Thus we are led to the supposition that these "electrons" identified in so many and various ways, are fundamental, and are probably constituents of all atoms. D. F. Comstock.

**Radium and the Electron Theory.** By John Trowbridge and William Rollins. *Am. J. Sci.*, **18**, 77–79.—This is an account of experiments, with negative results, to discover the effect of radium rays on metallic conduction. The author's reason that since X- and radium-rays change the conductivity of a gas through which they pass, it is possible that metallic conductivity may also be affected, although, considering the probable difference in the mechanism of conduction in the two cases, the *á priori* probability is rather against the existence of such an effect.

The experiment consisted in allowing radium rays to stream lengthwise through an aluminum wire carrying a current. The apparatus was capable of detecting a change in the apparent resistance of the wire of one one-hundred-thousandth of an ohm, but no change was detected. The radium was active enough to allow of its light being seen through a slab of iron 1 inch thick.

D. F. Comstock.

**Note on a Radioactive Gas in Surface Water.** By H. A. Bumstead and L. P. Wheeler. *Am J. Sci.*, **16**, 328.—During experiments made, in Connecticut, to discover a radioactive gas in water from great depths, the authors were led to test surface water, and they found to their surprise that the activity was greater in the latter than in the former. Gas was also drawn from 5 feet under ground, and found even more active than that from surface water. As regards the decay of activity these gases resemble the emanation from radium. D. F. Comstock.

**On Excited Radioactivity.** By R. M. Stewart. *Trans. Roy. Soc. Can.*, **8**, Sec. III., 97–103.—This is an account of experiments which show that positively charged bodies as well as those negatively charged, become radioactive after prolonged exposure to atmospheric air. This property of negatively charged bodies has been known for some time, but in general, it appeared that a positive charge did not have a similar effect in taking radioactivity from the air.

The author uses a simple form of electroscope with a removable zinc disk for a bottom. This disk is taken out, raised to the desired potential by means of a static machine, and exposed to the air for some hours. It is then replaced in the electroscope, and the radioactivity measured by observing the ionization of the enclosed air as shown by the rate of fall of the previously charged gold leaf.

The results show that the air possesses the power of inducing radioactivity in the cases of both positively and negatively charged

bodies, but the effects are much greater and more uniform in the latter than in the former case.

The theoretical implication is that, although the positive ions of the air in general are the most radioactive, yet radioactive negative ions apparently do exist. D. F. COMSTOCK.

**Excited Radioactivity from Atmospheric Air.** BY S. J. ALLEN. *Trans. Roy. Soc. Canada*, **8**, Sec. III, 71–78.—The author describes experiments on the characteristics of the radioactivity excited in a wire by exposure, while negatively charged, to atmospheric air. In this work a sensitive electrometer was used to measure the leak, instead of the usual gold leaf electroscope. The experiments warrant the following conclusions: The excited radioactivity resembles that produced by radium and thorium, but is more penetrating than either and decays more rapidly than the latter. Other things equal, the effect was stronger when the wire was exposed on a windy day, and is more vigorous in winter than in summer. It seems probable that the activity is due to the attraction to the wire of radioactive, positively charged ions from the air. How few of these ions there are is shown by the fact that no effect was obtained from the air contained in a thousand liter box. The author found no effect when the charge during exposure to the air was positive, thus contradicting the results referred to in the previous abstract. D. F. COMSTOCK.

**Molecular Conductivity.** BY C. J. REED. *Trans Am. Electrochem. Soc.*, 5, 103; *Electrochem. Industry*, **2**, 179.—The author believes that the conception of molecular conductivity of a dissolved salt at different dilutions is erroneous, and has no physical significance. M. DEKAY THOMPSON, JR.

**The Daniell Cell and the Gibbs-Helmholtz Equation.** BY H. S. CARHART. *Electrochem. Industry*, **2**, 130.—In this article the author calls attention to the fact that the strength of the solutions used by Jahn in his work on the Daniell cell were different from those used by Gockel in determining the temperature-coefficient of this cell. Yet Jahn used Gockel's data in combination with his own in testing the Gibbs-Helmholtz equation. This is not justifiable as the temperature coefficient is dependent on the concentration of the solutions. The author, therefore, concludes that the Gibbs-Helmholtz equation has not been verified for the Daniell cell, as the difference between the thermal energy and electrical energy is too small to give reliable evidence either way. M. DEKAY THOMPSON, JR.

**Structure and Tension.** BY OSCAR NAGEL. *Electrochem. Industry*, **2**, 97.—An attempt is made in this article to show that the structure of a metal is dependent on its position in the electrochemical series, but no facts in support of this theory are produced.

The statement is deduced theoretically that the difficulty of depositing electrolytically certain metals, such as magnesium, is due to the insolubility of its hydroxide. Judging from the data given in Comey's "Dictionary of Solutions," that of magnesium hydroxide seems to be at least as great as that of the hydroxide of many metals, such as copper, which are easily deposited, so this theory does not agree with facts. M. DEKAY THOMPSON, JR.

**The Theory of Electrode Potential.** BY WOOLSEY MCA. JOHNSON. *Electrochem. Industry*, 2, 97.—This article consists of a presentation of the thermodynamic theory and the osmotic theory of galvanic elements. M. DEKAY THOMPSON, JR.

**The Relation between Arsenic and Electromotive Force in Copper Electrolysis.** BY L. WEBSTER WICKES. *Electrochem. Industry*, 2, 137.—The extent to which the amount of arsenic deposited on the cathode depends on the voltage impressed at the terminals of an electrolytic cell for refining copper is the subject of this investigation. The author finds, using anodes containing equal percentage amounts of arsenic and an acid copper sulphate solution, that, for a given voltage, the relative amount of arsenic deposited at the cathode is the same, whether the anodes and cathode are far apart or near together. This observation seems to disagree with what was found to take place in two cells with anodes of copper containing 2.24 per cent. of arsenic, and an acid copper sulphate solution containing 0.101 per cent. As in the form of $As_2O_3$. Starting with a solution containing 0.101 per cent arsenic, the amount of arsenic deposited on the cathode was not greater than when the original solution contained no arsenic. The author concludes that the relative amount of arsenic deposited is a function of the amperage and of the degree of hydrolyzation of the arsenic sulphate.

M. DEKAY THOMPSON, JR.

**Electricity Direct from Carbon.** BY R. LORENZ. *Electrochem. Industry*, 2, 15.—This article was translated from a paper read before the Physical Society of Zurich.

The author explains Thomson's rule and Helmholtz's equation and applies them to various reactions, both exotherimc and endothermic. The oxidation of carbon to carbon dioxide is considered from the same standpoint. Various carbon oxygen cells are described, principally that due to Jacques. Also indirect methods of utilizing the energy of carbon are considered. In conclusion, the author calls attention to the fact that the carbon oxygen cell is a theoretical possibility, but that much has to be done before it becomes a reality. M. DEKAY THOMPSON, JR.

**Fuel and Heat Batteries.** BY C. J. REED. *Electrochem. Industry*, 2, 18.—This article is a critique of the Jones battery

(*Electrochem. Industry*, 1, 586) and of the gas battery of J. H. Reid (*Electrochem. Industry*, 2, 30). Calculations are given showing the former to be a commercial impossibility.

The similarity of the latter to the Jacques battery is pointed out. The author believes that the electromotive force is of thermoelectric origin. Incidentally the mistatement is made that only exothermic reactions can be the source of electrical energy. This has been shown experimentally not to be the case by Bugarszky (see *Jahrb. für Elektrochem.*, 4, 60).

M. DEKAY THOMPSON, JR.

**The Dynelectron.** BY S. D. V. BURR. *Iron Age*, December 8, 1904.—Description of a new form of battery, consisting of a cast-iron box 16x16x26 inches, containing the electrolyte—15 gallons of water with sodium hydroxide and iron oxide. Into the liquid there dips a water-tight box, from which project 64 porous carbon rods, bored out inside nearly to the end, their hollow interiors communicating with the tight box. Around the carbons, but insulated from them, are iron tubes, $^1/_{16}$ inch away from the outer surface of the carbons. The carbons form one pole of the battery and the iron tubes surrounding them the other. Air at a pressure of 10 to 12 pounds per square inch is admitted to the tight box, and filters slowly through the pores of the carbons to their outer surfaces; the electrolyte is between the carbons and their surrounding tubes, and the whole is kept at 392° F. to give best efficiency. Every 4 square inches of carbon surface gives 1 ampere, and a cell as described will give 600 amperes at 0.9 volt. The cell is kept hot by a gas furnace. J. W. RICHARDS.

**The Age of Science.** BY IRA REMSEN. *Science*, 20, 65-73.—A Commencement address at Worcester Polytechnic Institute, in which the speaker answers the questions propounded in his opening sentences: What is Science? In what sense is this the Age of Science? He regards the last quarter of the 18th century as perhaps the most fruitful period of advance, in chemistry at least, and that ours is called the scientific age not only because more attention is paid to scientific work, but because we are beginning to reap the fruits of early work, without always perceiving how dependent the rewards are upon the discoveries of the pioneers in Science. The speaker upholds the spirit which derives satisfaction from work done for the sake of discovery alone, and shows by examples the important connection that often exists between work originally of little or no seeming practical worth, and results of the highest value from the industrial point of view.

W. F. HILLEBRAND.

**[The Training of Technical Chemists.]** BY SIR WILLIAM RAMSAY. *J. Soc. Chem. Ind.*, 23, 852-857.—Annual address of the president of the Society of Chemical Industry, delivered in New York,

September 8, 1904. The importance of thorough scientific training is emphasized, but the mere acquisition of knowledge should be subordinated to the effort to produce an attitude of mind, which may develop the research or inventive faculty. How this can be cultivated is explained at some length. The methods of appointment, the duties, and the pay of instructors and professors are considered, as also the (in England) important question of examinations. Toward the close, the speaker's ideas for a model training school are tentatively sketched. The discourse is full of suggestion. W. F. HILLEBRAND.

**The Education of Technical Chemists.** BY EDGAR F. SMITH. *Chem. Engineer*, 1, 71–73; J. W. RICHARDS, *Ibid.*, 131–137; H. W. WILEY, *Ibid.*, 210–211; IRVING A. PALMER, *Ibid.*, 305–309.—In the first of this series of papers Dr. Smith thinks that, if the training has been thorough in the fundamentals of chemistry and in mechanical drawing, mathematics and physics, teachers will have done their duty. Dr. Richards outlines a very broad and long course of study from the common school up, with the object of producing the *best*, not an inferior, grade of technical chemist. In advanced work, principles, rather than the repetition of industrial processes on a small scale, or learning how to operate a machine, should be insisted on. Similarly, Mr. Palmer pleads for a broader and more thorough education of technical men, one which shall turn out educated men rather than mere artisans. Since most analysts in metallurgical works hope to rise to managerial positions it is necessary that they have a broader training than if they expect to remain always routine analysts. His wide experience shows that very many graduates from leading institutions are wholly unfit to hold positions in industrial laboratories. Their knowledge of analytical chemistry is inadequate, and they are often so deficient in theory as to be unable to devise new methods or modify old ones to meet changing conditions. Lack of good books on analytical chemistry is another want. In Dr. Wiley's opinion, better training in technique, without less thoroughness in theory, seems to be needed. His experience has been that while young graduates show weakness in the practice of chemistry, those who come from technical schools appear to better advantage in this respect than those from agricultural colleges and universities. W. F. HILLEBRAND.

**The Latent Power in, and Emanating from, the Laboratory.** BY R. H. CHITTENDEN. *Am. J. Pharm.*, 76, 325–329.—An address delivered at the opening exercises of the new medical laboratories of the University of Pennsylvania. The character of the influences that may emanate from a well-equipped and well-conducted laboratory are depicted and used as illustrations to indicate, first, the enormous latent power in such a laboratory for the

judicious training of students and for the discovery of important scientific truths, and, second, the intimate relationship which unquestionably exists between physiological chemistry and scientific medicine. W. F. HILLEBRAND.

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## MINERALOGICAL AND GEOLOGICAL CHEMISTRY.

**Replacement of Quartz by Pyrite and Corrosion of Quartz Pebbles.** BY C. H. SMYTH, JR. *Am. J. Sci.*, **19**, 277–285; plate, figure.—"The Oneida conglomerate [in Central New York]. . . . presents two types of solution of quartz, one accompanied by simultaneous replacement by pyrite, and thus metasomatic, the other purely destructive in its nature, and in harmony with the general tendency of weathering." The occurrences are fully described, but no definite conclusions are reached as to the agents that have produced the observed results. See also this Journal, **25**, R. 153.
W. F. HILLEBRAND.

**Occurrence and Distribution of Celestite-Bearing Rocks.** BY EDWARD H. KRAUS. *Am. J. Sci.*, **19**, 286–293; figures (see also this Journal, **26**, R. 370).—In this paper the occurrences of Put-in-Bay, Ohio, and Monroe County, Michigan, are described. The upper strata have been more or less leached by water, and the cavities once occupied by the celestite crystals are often perfectly preserved. At lower levels the dissolved strontium sulphate has often been redeposited in large crystals wherever cavities existed. W. F. HILLEBRAND.

**The Doughty Springs, a Group of Radium-Bearing Springs, Delta County, Colorado.** BY W. P. HEADDEN. *Am. J. Sci.*, **19**, 297-309.—This is the author's abstract of the paper already noticed in this volume of the Journal, R. 213.
W. F. HILLEBRAND.

**Chrysoberyl from Canada.** BY NEVIL NORTON EVANS. *Am. J. Sci.*, **19**, 316-318.—This is the first reported occurrence of the mineral in Canada, in Province of Quebec, about 100 miles north of Montreal, where it is found in pegmatite dikes traversing gneiss. Composition: BeO, 17.78; $Al_2O_3$, 76.76; $Fe_2O_3$, 6.07; total, 100.61. Specific gravity, 3.52. The iron may be in part ferrous.
W. F. HILLEBRAND.

**Souesite, a Native Iron-Nickel Alloy Occurring in the Auriferous Gravels of the Fraser, Province of British Columbia, Canada.** BY G. CHR. HOFFMANN. *Am. J. Sci.*, **19**, 319–320.—Occurs in the form of small, irregular, rounded grains, not exceeding a millimeter and a half in diameter, associated with platinum, iridosmine, and gold, besides magnetite, ilmenite, quartz, and

garnet. Color, faint yellowish steel-gray; luster, submetallic; strongly magnetic; malleable. Specific gravity at 15.5°, 8.215. Very slightly acted on by cold hydrochloric acid, slowly dissolved by the hot acid. Readily attacked by nitric acid, even dilute. Composition, after deducting over 1 per cent. of silicious matter (F. G. Wait, analyst): Ni, 76.48; Fe, 22.30; Cu, 1.22. Total, 100.00. Named after Mr. F. Soues, who furnished the material. In his comparison of this alloy with the few similar ones known, the author entirely overlooks the josephinite of Melville (*Am. J. Sci.*, **43**, 509 (1892); *Bull. U. S. Geol. Survey, No. 113*, p. 54.

W. F. HILLEBRAND.

**On the Absence of Helium from Carnotite.** BY E. P. ADAMS. *Am. J. Sci.*, **19**, 321-322.—Experiments having shown the absence of helium, notwithstanding the presence of radium, this is attributed to the porous character of the sandstone in which carnotite occurs, whereby the helium would be able to diffuse away as fast as formed, whereas the heliferous minerals are compact, impervious substances, able to retain the helium formed in them.

W. F. HILLEBRAND.

**Red Beryl from Utah.** BY W. F. HILLEBRAND. *Am. J. Sci.*, **19**, 330.—This is a brief note describing a beryl of unique color—a rich raspberry-red—from the Dugway Range, about 35 miles southwest from Simpson Springs. W. F. HILLEBRAND.

**The Occurrence of Tantalum Minerals.** BY DAVID T. DAY. *Electrochem. and Metal. Ind.*, **3**, 133-134.—A brief statement of known American occurrences of the minerals, with percentages of tantalum in minerals from domestic and foreign localities.

W. F. HILLEBRAND.

**Economic Geology of the Pembina Region of North Dakota.** BY CHARLES P. BERKEY. *Am. Geologist*, **35**, 142-152; plate, figures.—The chemical matter of this paper is limited to the results of rough tests of certain cement marls and clay shales.

W. F. HILLEBRAND.

**The Lignite of North Dakota and Its Relation to Irrigation.** BY F. A. WILDER. *U. S. Geol. Survey, Water Supply and Irrigation Paper, No.* 117, 59 pp.; maps, plates, figures.—The average amount of moisture in Dakota lignites fresh from the mines is 30 per cent. When shipped and handled in the usual way most of this moisture reaches the boiler, but "small samples that are more or less exposed to the air for two or three months reach the laboratory with from 10 to 20 per cent. of moisture . . . ." (see this Journal, **27**, R. 263). Because of the uncertainty as to the original moisture content in such coals, it is recommended to compute the composition, as to the combustible plus ash, on a dry basis. This has been done for the sixty analyses reported in the Bulletin, the

moisture found being given separately. The results of a few evaporative tests under natural and forced draft accompany the report. W. F. HILLEBRAND.

**Plumose Diabase and Palagonite from the Holyoke Trap Sheet.** BY B. K. EMERSON. *Bull. Geol. Soc. Am.*, *Vol.* 16, 91-130; map, plates.—The trap sheet in question represents a submarine overflow of what is in the main diabase, but which has been locally modified in a great variety of ways by the introduction, while still flowing, of mud, sand, and water of the sea-bottom. The various differentiates and their probable modes of formation are fully described, especially dark, much hydrated glass (palagonite), surrounded by an acid quartz-albite groundmass (holyokeite), which has also been extravasated in small dikes. Analyses by chemists of the Geological Survey of the materials under discussion, and of similar occurrences elsewhere by other analysts, serve in part as bases for the author's conclusions.

W. F. HILLEBRAND.

**On the Origin of Veins in Asbestiform Serpentine.** BY G. P. MERRILL. *Bull. Geol. Soc. Am.*, *Vol.* 16, 131-136; figures, plates—As a result of his examination of the occurrences at Thetford mines, Canada, the author is led to the view that the vein cavities are the result of shrinkage, and the filling is due to processes of crystallization extending from either wall inward.

W. F. HILLEBRAND.

**Underground Waters of the Eastern United States.** BY MYRON L. FULLER. *U. S. Geol. Survey, Water-Supply and Irrigation Paper*, No. 114, 285 pp.; maps, plates, figures.—This report, in which the analyses are confined to waters from Maine and Vermont, "includes papers by twenty geologists, and embraces discussions of the conditions in each State, and of the general occurrence of underground waters as a whole."

W. F. HILLEBRAND.

**Preliminary Report on the Geology and Water Resources of Central Oregon.** BY ISRAEL C. RUSSELL. *U. S. Geol. Survey, Bull. No.* 252, 138 pp.; maps, plates, figures.

W. F. HILLEBRAND.

**Report on Progress of Investigations of Mineral Resources of Alaska in 1904.** BY ALFRED H. BROOKS and others. *U. S. Geol. Survey, Bull. No.* 259, 196 pp.; maps.—This report contains fourteen papers by ten authors, dealing with the gold, tin, coal, and oil resources and developments in a number of districts. Under the reports on coal is to be found the only chemical matter, proximate analyses of coals from the Bering River field, the fields of southwestern Alaska, and of Cape Lisburne region.

W. F. HILLEBRAND.

**Report of the State Geologist on the Mineral Industries and Geology of Certain Areas of Vermont, 1903-1904.** By George H. Perkins. 236 pp.; maps, plates.—The building and ornamental stone industries are the ones that receive most attention, though limestone, soapstone, kaolin, fire-clay, talc, asbestos, and metals are considered. There is also a chapter by W. F. Marsters, on the "Serpentine Belt of Lamoille and Orleans Counties," besides other chapters, by various authors, which offer little or nothing of interest to the chemist, except that on the hydrology of the State, in which occur a few analyses of waters.

W. F. Hillebrand.

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## ANALYTICAL CHEMISTRY.

**The Determination of Rosin in Shellac.** By A. C. Langmuir. *J. Soc. Chem. Ind.*, **24**, 13—The determination is based on the difference in the iodine absorption values of rosin and of shellac. The iodine solution is made up according to the method of Wijs. Fifty-one grams of pure iodine are dissolved in glacial acetic acid (free from reducing impurities), and the solution made up to 4 liters. The iodine content is determined by titrating 20 cc. with tenth-normal sodium thiosulphate. Two hundred and fifty cc. are reserved, and pure chlorine is passed into the remainder until the characteristic color change takes place. Portions of the reserved 250 cc. are added until the thiosulphate used in titrating 20 cc. is just twice that required by the unchlorinated solution. If kept in a cool, dark place, the solution is quite stable.

One-fifth gram of ground shellac is introduced into a 250-cc. bottle having a tight-fitting stopper. Twenty cc. of glacial acetic acid are added, and the mixture warmed gently until solution is complete, except for wax. Pure shellac is rather difficultly soluble. Ten cc. of chloroform are added, and the solution cooled to 21°-24° C., at which temperature the determination must be made. Twenty cc. of Wijs' solution are introduced from a pipette with a small orifice. Rosin in small amount produces a slowly-appearing reddish brown coloration. A large amount gives this effect at once. The bottle is stoppered and put in a dark place. After one hour, 10 cc. of a 10 per cent. potassium iodide solution are added, and the mixture titrated at once with tenth-normal thiosulphate. Just before the end-point a little starch solution is added. The end-point is sharp, as the reaction products dissolve in the chloroform. A blank test is then made with 20 cc. of Wijs' solution, 20 cc. of glacial acetic acid and 10 cc. of chloroform. If D is the number of cubic centimeters of thiosulphate used in the blank test minus that in the test proper, then the per cent. of rosin can be computed from the following formula:

$$\% = \frac{100}{228-18}\left(\frac{100 \times \mathrm{D} \times \text{iodine equivalent of thiosulphate}}{\text{weight of shellac taken}} - 18\right).$$

Eighteen is the iodine absorption value of shellac, that of rosin being 228. By analyses of shellacs of known rosin content, the results are shown to be fairly accurate. T. G. DELBRIDGE.

**The Volumetric Determination of Methylene Blue.** BY F. PELET AND V. GARUTI. *Chem. Eng.*, 1, 163.—A weighed amount of the methylene blue to be analyzed is dissolved in distilled water and made up to a known volume containing about 1 per cent. of the dye. Alcohol must be absent. A definite volume of this solution is titrated with a 1 or 2 per cent. aqueous solution of crystallized ponceau until a little of the liquid dropped on filter-paper just ceases to show a blue border. The ponceau solution is standardized in the same way, using pure methylene blue. The results obtained by this method are accurate to about 0.2 per cent. Carmine as the sodium salt, pyramine orange, or cotton brown may be substituted for ponceau. T. G. DELBRIDGE.

**Crude Oil for Fire Assaying.** BY F. C. BOWMAN. *Eng. Min. J.*, February 2, 1905 (read before Colo. Sci. Soc.).—A new 2-muffle furnace built to burn coal was run by a burner having a ½-inch steam pipe and a ¾-inch oil pipe leading to a supply tank 14 feet above the burner. The oil is atomized by the steam, and the flame impinges at 12.5 inches from the nozzle on some fire-bricks, which deflect it upwards against the bottom of the lower muffle. The fire is started by some oiled waste. The steam should be dry, and is passed through a pipe coiled around the chimney; there is also a drip near the burner to remove condensed moisture. A small steam coil in the oil tank warms it up and makes the oil flow more freely. The muffles will be red-hot fifteen minutes after starting; in thirty to forty-five minutes the crucibles will be ready to pour. The furnace uses 4.2 to 5.3 gallons of oil per hour; with oil at 8.7 cents per gallon, the cost of oil is 2.2 to 2.8 cents per assay run. Using coke at $2.25 per ton, the fuel cost was 7.1 cents per assay; and with gasoline at 40 cents per gallon, 5.2 cents per assay.
J. W. RICHARDS.

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## METALLURGICAL CHEMISTRY.

**Metal Production in 1904.** *Eng. Min. J.*, January 5, 1905.—With its usual promptitude, the first number of this journal for 1905, contains preliminary estimates of the mineral and metal production of the United States for 1904, as follows:

Pig iron, 16,563,938 long tons; value, $13.25 per ton.
Copper, 748,540,800 lbs.; value, $0.13 per lb.
Gold, 4,090,532 oz., Troy; value, $20.67 per oz.
Silver, 53,603,000 oz., Troy; value, $0.57 per oz.
Lead, 627,016,000 lbs.; value, $0.043 per lb.
Zinc, 353,698,000 lbs.; value, $0.051 per lb.

Aluminium, 8,000,000 lbs.; value, $0.31 per lb.
Mercury, 3,262,425 lbs.; value, $0.547 per lb.
Antimony, 4,633,036 lbs.; value, $0.07 per lb.
Nickel, 100,000 lbs.; value, $0.47 per lb.
Bismuth, 10,891 lbs.; value, $2.10 per lb.
Platinum, 120 oz., Troy; value, $19.50 per oz.

J. W. RICHARDS.

**Methods of Pyrometry.** BY C. W. WAIDNER. *Iron and Steel Mag.*, December, 1904. (From Proc. Eng. Soc. of Western Pennsylvania).—A very interesting and valuable contribution to the literature of this subject, offering nothing new, but a clear exposition of the principles and manipulation of different pyrometers. With Dr. Burgess, of the Bureau of Standards, Mr. Waidner has written a particular study of "Optical Pyrometry," which has been published as a bulletin of the Bureau.

J. W. RICHARDS.

**The Fuel Testing Plant at St. Louis.** *Mines and Minerals*, January, 1905. (From Bull. U. S. Geol. Survey).—A description of the testing plant and of the important work which it accomplished during 1904. All the equipment was donated by the makers, and the government paid the running expenses. It is possible that the plant may be located permanently at Washington.

J. W. RICHARDS.

**Making of By-Product Coke.** BY E. A. MOORE. *Iron Trade Review*, February 9, 1905 (read before Philadelphia Foundrymen's Association).—A long, illustrated lecture on modern ovens. The waste products of coking are worth $0.80 to $1.00 per ton of coal coked. There are at present in the United States 2,605 Hoffman ovens, and 1,345 Semet-Solvay ovens, carbonizing altogether 8,400,000 tons of coal per year. The average yield per ton of coal is 70 to 75 per cent. of coke, 10 gallons of tar, 5 pounds of ammonia, and 9,000 to 10,000 cubic feet of gas. The whole operation is carefully described in detail.

J. W. RICHARDS.

**Carborundum Fire-sand.** BY F. J. TONE. *Metal Industry*, February, 1905.—This new refractory material is uncrystallized carborundum, SiC. A mixture is made of 90 parts fire-sand and 10 parts by weight of thin syrupy solution of sodium silicate of density about 33° Baumé. This makes a plastic mixture easily molded, which can be tamped into place and slowly dried out and brought up to heat. Such a lining in a crucible furnace will outlast several fire-brick linings. For this use, 10 per cent. of fire-clay may be added to the foregoing mixture. A mortar of 50 to 60 per cent. fire-sand and 40 to 50 per cent. fire-clay has many uses. Lead and copper smelting furnaces having side walls of this mortar have been very successful, and Tropenas and copper matte converters are often patched with it.

J. W. RICHARDS.

**Flame Regulation in Chemical and Metallurgical Operations.** By C. Ellis. *Electrochem. Industry*, December, 1904.—An account of the Eldred system of regulating the intensity of the combustion of fuel, by mixing the air used with such an amount of the products of combustion themselves that the percentage of free oxygen is much reduced, and that the extra amount of nitrogen and carbon dioxide cause the temperature of combustion to be much lower than usual, the fuel burns slower, and the heat evolved is carried away into the furnace and distributed better by the large body of gaseous products. The gases passing to the chimney also will be richer in carbon dioxide, and, therefore, carry away less heat. This will be true only when a large excess of air is used to start with. For some purposes, the large body of gaseous products of combustion bearing the heat of combustion will facilitate economical transfer of the heat to the substances being heated, and so cause economy. J. W. Richards.

**A Pump for Molten Metal.** *Metal Ind.*, November, 1904.—Description of a cylinder pump to be operated by hand or power, which is immersed in the low-melting metal, such as solder or type metal, and has an external delivery spout kept hot by a series of small gas burners, to prevent chilling of the metal as it is pumped out. J. W. Richards.

**Fundamental Principles of Blast-Furnace Practice.** By E. A. Uehling. *J. Franklin Inst.*, February, 1905.—To produce with greatest possible regularity and fuel economy the maximum quantity and correct quality of iron, many points must be kept under control. *The ore* should be a regular mixture, and the finer the more refractory it is, in order to be readily reduced. Some ores are too fine; 20 per cent. of Mesabi ore will pass through an 80-mesh sieve, and as much as 3 to 5 per cent. of it will be carried over as flue dust. *Crushing* should be done at the mines, and all hard ores should be crushed to a given size, the finer the more refractory they are; magnetites should be crushed finer than hematites, down to a 2-inch size, at most. Sizing of the ore is important, but seldom given much thought. The worst possible mixture is of both coarse and fine so proportioned that the latter fills all the interstices between the former. Such a mixture is worse than all fines. Ores should be separated into coarse, medium, fine and dust, corresponding to over 1.5 inches, 0.5 to 1.5 inches, 0.05 to 0.5 inch, and under 0.05 inch. The latter should be briquetted or else smelted by itself. The three other sizes should be charged in alternate strata in the furnace so as not to mix. *Roasting* is rarely resorted to in America, except for removing sulphur, but all magnetic ores are rendered more easily reducible by roasting. *Briquetting* of the dust is necessary if the latter is to be run in the same furnace. It is better to smelt it alone in another furnace, or to smelt the fines electrically with power derived

from the utilization of the blast-furnace gases in gas-engines. *Flux* should be well broken to uniform size, with as little dust as possible. *Slag* acts physically as a filter to purify the globules of iron as they pass through it, also as a protection of the iron against oxidation by the blast; also chemically in carrying off sulphur and regulating the silicon content of the iron. Magnesia is a stronger flux than lime, but does not take off sulphur as lime does (?). Alumina should be kept as low as possible(?), since it largely reduces the fluidity of the slag(?). Fuel may be raw coal, charcoal, anthracite or coke; the latter is replacing all the others. The fuel keeps the charges open, and should therefore be coarse, rough and uniform in size. Dust or breeze should never be charged. The fuel should be porous without being weak, so as to burn rapidly before the blast and not crushed. Hard-burned coke is best in these respects; also because it is less actively oxidized by carbon dioxide in the upper part of the furnace. The ash of the fuel should be as low in alumina and as high in silica as can be had; any iron in it adds to the product of the furnace. A high silica ash aids in making high-silicon iron, as the silica in the ash furnishes most of the silicon in the iron(?). *Blast* is usually furnished in varying quantity, at irregular temperatures, at variable pressures and contaminated by varying amounts of moisture. Blowing a definite volume is better than blowing at a constant pressure, because by the latter method the furnace is apt to receive the least air when it needs the most. Some 10 to 15 per cent. of the piston displacement is lost in leaks, etc. Variations in the barometer affect the volume sometimes 6 to 10 per cent. Stopping of small leaks in the mains may easily produce a gain of 5 tons of iron a day. *Hot blast* should be at as regular a temperature as possible; variations of 200° to 300° F. or more are not infrequent, amounting to variations representing 6 to 10 per cent. of fuel in the hearth. In Germany 1500° to 1600° F. is common, in England 1400° to 1500° F., and in America the average is scarcely above 1000° F. It is more economical to increase the efficiency of the stoves by washing the gases burnt in them than to build larger stoves or more of them. Autographic pyrometers to record the exact temperature of the blast should be at every furnace. Drying of the blast is a step in advance second only in importance to the hot blast. *Slipping* at the top seems to be due partly to the nature of the ore smelted, since Mesabi fine ore causes more numerous slips and can be largely avoided by reducing the height and altering the lines of the furnace. Slipping at the bottom occurs in the zone of fusion, and is due to temperature variations caused by variations in blast-temperature, moisture and volume. Very basic slags build up and cause slips more often than acid slags; high alumina slags are especially bad. The oil blowpipe or the electric arc are often used to soften up and melt these slips or unmelted material. *The gases* indicate very closely how the furnace is running; autographic tem-

perature recorders enable the manager to see at once if the furnace is going wrong, for an increase of 100° F. in their temperature means an indirect fuel loss to the furnace of 10 to 15 per cent., which will quickly make its effects visible in the iron. A continuous record of the carbon dioxide in the gas would be of greatest value to the manager, since the first symptoms of irregular reduction show in the composition of the gas. Most furnaces will be able to give surplus power equal to 40 or 50 horse-power for every ton of iron made per day, if the surplus waste gas is used in gas-engines. The gases contain 45 to 50 per cent. of the calorific power of the coal; 35 to 50 per cent. of them is needed to heat the blast and produce power to run the furnace, and the rest is all available for surplus power.

J. W. RICHARDS.

**The Mullen Gas Washer.** *Iron Trade Rev.*, February 16, 1905.—The gas from the blast-furnace is divided into 200 to 250 small streams in the washer and led to a point 2 to 4 inches above a surface of water. It is impossible for the gas to change its course and turn upwards without impinging against the water surface. The fresh water supply is introduced 4 inches below the surface, thus keeping the surface cool and diminishing evaporation. The overflow is at the upper surface, thus removing the hottest water.

J. W. RICHARDS.

**Stock Distribution in Blast-Furnaces.** BY J. E. RAYSOR AND J. J. PORTER. *Iron Age*, January 12, 1905.—Description of a rotating feeder, either in the shape of cars rotating around the hopper of the furnace or of a rotating hopper which distributes the stock while revolving, and so drops it uniformly distributed into the lower hoppers. All moving parts are above the gas-seal, away from heat and dust and readily accessible.

J. W. RICHARDS.

**The Preparation of Fine Material for Smelting.** BY T. J. GREENWAY. *Eng. Min. J.*, January 12, 1905.—After many experiments, the following procedure, similar to the "semi-dry brick-pressing" process has been adopted for silver-lead concentrate and slime: (1) Mixing with water and newly slaked lime. (2) Pressing into blocks of the size and shape of ordinary bricks. (3) Stacking in suitably covered kilns. (4) Burning with oxidizing atmosphere so as to harden without melting, and at the same time to eliminate sulphur, arsenic, etc. With briquettes containing much sulphur or other combustible the kiln needs firing only ten to twenty hours and then burns itself for from three to six days. With labor costing 25 cents per hour and wood or coal $4 per ton the total costs are $1 to $1.50 per ton of material.

J. W. RICHARDS.

**The Manufacture of Steel.** BY W. METCALF. *Iron and Steel Mag.*, November, 1904.—(Read at International Engineers Congress, St. Louis). A comparison of the industry in 1892 and 1902. Bessemer converters have not been increased in capacity; open-hearth furnaces have been enlarged from 35 tons up to 75 tons capacity. The output of Bessemer steel increased about 100 per cent., that of the open-hearth steel 700 per cent., that of crucible steel 35 per cent. The quality of crucible steel has not been in any way improved. In open-hearth practice great improvement has been made in handling large heats so as to produce more uniform steel; it is now possible to make with regularity open-hearth steel between 0.90 and 1.10 per cent. of carbon, suitable for springs. Manufacturers will now agree to furnish open-hearth steel within 0.02 or 0.10 per cent. of the carbon required, as the latter varies from 0.1 to 1.0 per cent. Melting of the steel is the place where it is most frequently spoiled. Metallographers have proved the sensitiveness of steel to heat variations, which were all along known to and acted upon by practical men; but the microscope examines spots only as large as pin-heads, while a skilled steel worker can see the condition of the steel by a glance at the fresh fracture. The greatest advance has been made in alloy steels, particularly for high-speed tool-steel. The latter usually consists of medium carbon, generally under 0.80, very little manganese, from 10 to 20 per cent. of tungsten or molybdenum, and generally from 3 to 4 per cent. of chromium. J. W. RICHARDS.

**Basic Open-hearth Steel without Scrap.** *Iron Trade Rev.*, February 23, 1905.—The practice at Ensley, Ala., is to run the pig iron into a 250-ton rolling open-hearth furnace, which acts as a reservoir, and by use of basic slag partly desiliconizes the iron; the iron is run in 15-ton lots into an acid-lined Bessemer converter where the silicon is completely removed with some of the carbon and the iron made very hot. The blow is stopped before decarbonization is complete, and the metal run into 50-ton basic open-hearth furnaces, of the rolling type, where it is dephosphorized and made into steel. J. W. RICHARDS.

**Rolled-steel Car Wheels.** BY S. M. VAUCLAIN. *J. Frank. Inst.*, February, 1905.—Loads upon car wheels have increased 50 to 100 per cent., whereas it has been impossible to increase the weight of the wheel in like proportion because of the limitations of frogs, switches, etc. The ingot is cut into sections, each large enough to make a wheel, and one of these is taken hot from a heating furnace to a 5,000-ton hydraulic press, which presses it roughly into the shape of a wheel. This form is then brought to the rolls, which consist of one pair for rolling the web, a pair for the edges of the rim and one roll for facing the tread. These five rolls acting together bring the wheel into finished shape. Chemical

and physical tests show very uniform properties of every part of the wheel. J. W. RICHARDS.

**Production of Copper in 1904.** BY F. HOBART. *Eng. Min. J.*, January 5, 1905.—The $95,588,660 worth of copper produced in the United States was 55 to 60 per cent. of the world's production. Of the above, Montana contributed 33 per cent., Michigan 28 per cent., Arizona 25 per cent. and Utah 5.5 per cent.; Arizona increased the most over 1903, some 20 per cent.

J. W. RICHARDS.

**Production of Mercury in 1904.** By V. SPIREK. *Eng. Min. J.*, February 16, 1905.—The output of four countries was 3,391 metric tons, of which the United States produced 1,480 tons (44 per cent.), Spain 1,020 tons (30 per cent.), Austria 536 tons (16 per cent.), and Italy 355 tons (10 per cent.). The total equals 100,374 flasks of 75 pounds each. An estimate of the quantity from Russia, Mexico, Japan and Germany is 590 tons, making the total 3,980 tons, or 136,460 flasks. J. W. RICHARDS.

**The Granby Copper Mine.** BY D. E. WOODBRIDGE. *Iron Age*, December 1, 1904.—There is an immense mass of low-grade ore, averaging 1.7 per cent. copper, $1.60 in gold and $0.33 in silver per ton, the gross value being $6.00 per ton. The ore is practically self-fluxing, carrying 35 to 45 per cent of silica, 15 to 20 per cent. of iron, 16 per cent. of lime and 3.5 to 4 per cent. of sulphur. Mining is largely done above ground, by a steam shovel. The smelter puts through 1,800 tons of ore a day, using 11 to 13 per cent. of coke and making a 45 to 50 per cent. matte. This is blown in Bessemer converters to 99 per cent. blister copper, the converter linings being of clay and gold-bearing silicates, the values of which are thus saved in the copper. Smelting costs are $2 per ton. J. W. RICHARDS.

**A Revolving Hearth Roasting Furnace.** *Electrochem. and Metal. Ind.*, February, 1905.—Description of the Holthoff furnace, which is circular, with the roof, sides and stirrers fixed, and the circular hearth movable. The ore is thus carried bodily around the furnace, which advances it more uniformly than when the hearth is fixed and the stirrers move, while the stirrers can be air- or water-cooled and much more accurately adjusted. A gas-producer in the center furnishes the combustible and makes the plant very compact. On the low sulphur ores of Cripple Creek the furnace has a record of nearly 100 tons of ore a day, roasted from 2.57 per cent. of sulphur down to 0.14 per cent., using 190 pounds of coal per ton of ore charged. J. W. RICHARDS.

**Use of Magnesium in Casting Copper.** BY E. S. SPERRY. *Brass World*, February, 1905.—Make a rich alloy of 45 pounds of Lake copper to which is added 5 pounds of magnesium in sticks,

which are held in tongs under the surface of the copper until melted, stir with a plumbago stirrer and pour into small ingots. This alloy is stirred into the melted copper to be cast, one pound of alloy to 100 pounds of copper. It renders the copper sound with less detriment to its electrical conductivity than any other deoxidizing agent, since magnesium itself has 75 per cent. of the electrical conductivity of pure copper. The crucible is left in the furnace for five minutes after the magnesium alloy is added. Castings with 96 per cent. of the conductivity of pure copper have thus been made. The magnesium acts by reducing cuprous oxide and destroying carbon monoxide, forming carbon and magnesium oxide.

J. W. RICHARDS.

**Fire-Cracks** BY E. S. SPERRY. *Brass World*, January, 1905. —These are the cracks which form while metals are being reheated or annealed. Bismuth in brass (0.5 per cent.) causes abundant fire-cracks. They seem also to be confined exclusively to alloys, and, further, to those which have been worked cold. The cause is undoubtedly that the metal is compressed strongly on the surface, but not so much towards the center, and, on heating, the strained outside breaks because of its small elongation. Tubes show this phenomenon plainly, and can be cured of fire-cracking only by heavy reductions in drawing, which work the metal into the center. All alloys which harden quickly when rolled or drawn are apt to fire-crack. If such rods are rolled into an arc before being heated, they will not crack. Thin tubing or rods are "whipped" upon a flat board; hollow-ware articles are "belted" by beating with a wooden mallet as strongly as they can stand. In all these cases the violent concussions seem to relieve the molecular strain and to thus avoid the tendency to fire-cracks.

J. W. RICHARDS.

**Bronzes for Steam Uses.** BY S. L. KNEAS. *J. Frank. Inst.*, January, 1905.—A mixture of 7 copper to 1 of tin, and a little more zinc, makes a good hydraulic bronze, with sufficiently high tensile strength, machining well and running solidly in the mold. The metal should be well stirred while in the casting ladle, especially if lead is present. Rapid cooling, obtained by pouring the metal cold, increases its density and strength; the average of hot, poured metal was a density of 8.915, of the same metal poured cold 8.661. A piece cast in an iron mold had a density of 9.285; the same cast in sand, and therefore, cooled slowly, 8.61.

J. W. RICHARDS.

**Magnolia Metal.** BY F. C. STANLEY. *Brass World*, January, 1905.—An analysis of this well-known and largely-used anti-friction metal showed it to contain lead 78.27 per cent., antimony 17.81 per cent., tin 3.88 per cent., copper 0.04 per cent. It can be

duplicated by melting together lead 85 pounds, antimony 15 pounds, tin 5 pounds. J. W. RICHARDS.

**A New White Metal for Sand Casting.** BY E. S. SPERRY. *Brass World*, January, 1905.—A metal for hardware, harness trimmings, ornaments, etc., containing copper 50, zinc 34.9, nickel 15, aluminum 0.1 per cent. The alloy loses 1.5 per cent. each time it is melted. The aluminum is added as 5 per cent. zinc-aluminum alloy. The nickel (50 pounds) is put in the bottom of the crucible, the copper (15 pounds) above it, and above it some flux composed of equal parts of borax and common salt. A charcoal cover is put on, and the whole melted rapidly. After it is melted, add 36 pounds of best zinc, then 2 pounds of the aluminum alloy, mix well and pour. It is too hard to roll well, but makes excellent sand castings. J. W. RICHARDS.

**Review of the Zinc Industry.** BY F. MEYER. *Electrochem. and Metal. Ind.*, January, 1905.—Five plants in the United States are now making sulphuric acid by roasting zinc blende, one, the Mineral Point Zinc Co., using the Schroeder contact process. The clay retorts have been so much improved, particularly by the use of Mehler's hydraulic press, that they frequently run from six to eight weeks. E. Lungwitz proposes to reduce zinc ores in a shaft furnace, using a pressure of 45 pounds per square inch in order to keep the zinc in the liquid state in the furnace. The process will be practically tried this year on a commercial scale, in this country. Zinc dust (blue powder) is now being regularly manufactured by the New Jersey Zinc Co., by the process of Converse and De Saulles, in which zinc vapors are expanded in a large chamber. If a material for zinc retorts more refractory than clay could be obtained, a better extraction than the present 90 per cent. of the zinc in the ore might be looked for. The greatest improvements possible lie in the saving of fuel, the consumption of which is still four times the weight of the metal produced. A central gas-plant and gas firing with regenerative furnaces might be the means of great economy. J. W. RICHARDS.

**Sulphur Compounds in the Zinc Retort.** BY W. MCA. JOHNSON. *Electrochem. and Metal. Ind.*, January, 1905.—In a properly conducted roasting of zinc blende, the percentage of sulphur left in the ore as zinc sulphate will be under 0.1 per cent. The temperature of decomposition of zinc sulphate at atmospheric pressure is 739° C., and since the roasting furnace is 200° to 300° hotter than this, all sulphate should be decomposed, if the charge is properly rabbled. Since iron sulphate decomposes at about 639°, there is none of it left in a properly handled roasting operation. Lead sulphate is formed, and not decomposed at the roasting temperature. Lime in the ore will take up sulphur as sulphate, which can-

not be further eliminated by roasting; probably 95 per cent. of the lime present will act this way, and the avoidable sulphur in the roasted ore is the total sulphur less that necessary to form calcium sulphate with the calcium oxide present. Magnesium oxide can undoubtedly act similarly, but can be decomposed by a high heat; ores roasted between 900° and 1075° will have 80 to 90 per cent. of the magnesia in them remaining as sulphate. Besides this "sulphate sulphur," there is present in the roasted ore some 0.05 to 0.50 per cent. of sulphur as sulphide of zinc, iron, lead or a similar metal, due to imperfect roasting, lack of proper stirring, too low heat or too little oxygen. It is doubtful how much of this is present as zinc sulphide. Iron decomposes zinc sulphide at 1167° C.; the action is slow with solid iron, but at 1250°, with melted iron, is quite active. Carbon begins to decompose zinc sulphide at 1200°; at 1300° this action is not so rapid as the reduction by melted iron. There is thus no doubt that with a temperature of 1200° to 1300° in the zinc retort, a considerable proportion of zinc sulphide in the roasted ore may be decomposed in the eighteen hours treatment, but the ferrous sulphide formed is very corrosive to the retorts, while any carbon disulphide formed gives difficulties in the condensers by re-sulphurizing zinc, and depositing sooty carbon. The behavior of sulphates in the retorts is less clear, but it is certain that 0.5 per cent. of sulphur as sulphates causes imperfect condensation in the retorts, because of the carbon disulphide formed. The statement that "1 per cent. of sulphur holds back 2 per cent. of zinc" has no foundation, in fact; it is certain, however, that properly roasted ore gives better results in the retorts than imperfectly roasted ore.

J. W. Richards.

**The Decomposition and Formation of Zinc Sulphate by Heating and Roasting.** By H. O. Hofman. *Technology Quarterly*, December, 1904 (read before American Institute of Mining Engineers).—A splendid paper of 43 pages, treating the subject under the four headings: (1) Decomposition by Heating in Air; (2) Decomposition by Heating with Carbon; (3) Formation by Roasting; (4) Formation of Zinc Ferrate. By heating in air, 36.29 per cent. of water is driven off at 109° C., 41.71 per cent. (altogether) at 263°, and the remaining 0.24 per cent. only at the commencement of decomposition of the sulphate, 538° C. On further heating, evidences of sulphur dioxide are first obtained on slow heating in a current of air at 528°. The lowest temperature at which complete decomposition takes place is 739°, but it takes a long time to attain, some fourteen hours; at 770° decomposition was complete in twelve hours; at 803° in eight hours. Regarding the action of carbon on zinc sulphate, reaction begins at 409° C., but is very weak, and is slightly stronger with increasing temperature, but only becomes decidedly active at 528°, at which point,

under the most favorable conditions 83 per cent. of the sulphur is expelled in the gaseous state, leaving 7 per cent. present as zinc sulphide, and 10 per cent. as zinc sulphate. In roasting zinc blende, decrepitation started with some varieties at 290° C.; ignition in a current of air begins with Joplin blende at 480° C., with non-decrepitating Warren blende at 515°, on fine material; blende from New Mexico at 534°. The presence of an iron sulphide raises the ignition point some 4° C. for each 1 per cent of iron present. The tests show only a small percentage of sulphate formed during roasting, since the roasting temperature is too high for sulphate to form quickly. Addition of iron pyrites to the material increased the amount of sulphate formed considerably, nearly doubling it. In the latter case, some indeterminate compounds of zinc oxide and ferrous oxide seem to form, but not the definite zinc ferrate, $ZnFe_2O_4$. J. W. RICHARDS.

**Investigation of the Properties of Zinc Coatings.** BY C. F. BURGESS. *Electrochem. and Metal. Ind.*, January, 1905.—The resistance to corroding agencies was determined on twenty samples, immersed in a 3.2 per cent. solution of sulphuric acid at room temperature for successive five minutes up to one hour, determining the loss of weight per dip. The weight of the zinc coat is 25 to 28 grams per square foot for hot galvanizing, and 8 to 34 grams for electrolytic deposits. In all cases, the hot process zinc was removed in less than an hour, while an equal thickness of electrolytic coating stands over eight hours' immersion. The reason is the greater purity of the latter. Tests of adherence of the coatings were made by soldering a brass plug to the coating by tin solder, and determining the pull necessary to tear the coating from the iron. Zinc deposited from a zinc sulphate solution took 482 pounds per square inch to tear it from the iron; hot galvanized coating 280 pounds. The degree of adherence depends very much on the preparation of the iron previously to being coated. Electrolytic zinc coatings show more tendency to blister when heated than the hot galvanized. When the sheet is bent, electrolytic coatings show themselves much more malleable and tough than the hot coatings, which latter are brittle and peel off easily. Under the microscope, the hot galvanized coating is very porous with minute holes; electrolytic coatings are also porous when lighter than 10 grams per square foot. When twice that heavy they show no perforations. The hot coating is more uniform in thickness than the electrolytic coating, the latter defect being due to non-uniform distribution of current. A number of samples were tested as to their resistance to abrasion by being rolled about in a tumbling barrel with quartz sand. There is very little difference between the coatings in this respect. To be as durable as the hot coating, the electrically deposited zinc should weigh 12 grams per square foot, requiring 10 ampere hours per square foot for its de-

position, and the current density should not be over 18 to 20 amperes per square foot, on account of the liberation of hydrogen; 14.5 ampere gives good results, depositing zinc with an efficiency of nearly 100 per cent. It is difficult to electrically deposit over 30 grams per square foot, on account of the roughening of the deposit. Best results are obtained by neutral zinc sulphate solutions; free acid present diminishes the efficiency of the protection afforded by the zinc. Improvements are needed in the use of baths which can be run at higher current densities, so that thicker deposits can be obtained and greater stability and uniformity of operation attained. J. W. RICHARDS.

**Electrolytic Refining of Lead.** BY R. L. WHITEHEAD. *Mines and Minerals*, January, 1905.—Description of the Betts process plant at Trail, B. C., which the writer states was run until March, 1903, at a cost of $29 per ton of lead produced, and which he then took charge of and reduced the costs to $10 per ton, by remodeling the entire plant save the kind of tanks used. The number of tanks was increased from 28 to 72, the 44 new ones being placed tandem, so that the plates were parallel with the length of the tank, needing only 40 per cent. as much copper in conductors. The circulation was also much improved by this arrangement. Treeing of the lead begins as soon as there is 1 per cent. difference in the percentage of lead at the bottom and top of the tank. The anodes weigh 300 pounds, and are treated in six days; the anode scrap is 22 per cent. The cathodes weigh 150 to 200 pounds. The melted cathodes are poled for thirty minutes to remove antimony and tin. About 6 pounds of glue are added daily to 2000 cubic feet of electrolyte, preventing treeing and giving a crystalline deposit. The slimes are washed 3 times by boiling water, decanting between, to remove fluosilicic acid and lead fluosilicate, but they still contain 1 per cent. of the acid after the washing. The solution is evaporated to 30° Baumé, and gradually returned to the tanks. All the iron, nickel, aluminum and some of the tin of the anodes go into solution, copper forms an insoluble salt, and very little arsenic or antimony goes into solution; zinc partly dissolves and partly deposits; bismuth remains entirely in the slimes. The slimes, after washing, are boiled with 200 pounds of caustic soda to 1000 pounds of slimes, using 2500 pounds of water; all antimony present as oxide is dissolved, thus removing about half of the antimony in the slimes. The solution is filtered and evaporated, and the antimony (with some arsenic) can be deposited by electrolysis, using a current density of 12 amperes per square foot of depositing surface. The slimes are next treated eight hours in a lead-lined tank, with 15 per cent. sulphuric acid, air being blown through, and copper, iron and bismuth are thus dissolved. The solution and wash-waters are evaporated and crystallized to copper sulphate and sulphuric acid.

The slimes are next dried on a steel pan, mixed with 400 pounds of soda-ash and 50 pounds of saltpeter per ton, and charged into a water-jacketted reverberatory furnace lined with magnesia fire-brick. A thin slag of sodium antimoniate forms, which can be readily skimmed off, and which will not carry over 30 ounces of silver per ton; next the heat is raised, and lead oxidized freely, with antimony and copper, to a very fusible thin slag, which will carry 150 to 200 ounces of silver and 0.5 ounce of gold per ton. After two hours' oxidation and skimming, there remains *dore* silver 900 fine; to remove copper still further, a 0.5-inch air blast is blown on the surface of the metal, making slag of copper oxide and lead oxide carrying 3,000 ounces of silver per ton. After three hours' blowing, the bullion is 950 fine, which is cast into 500-ounce bars and parted by sulphuric acid. There is neither tellurium nor selenium in these slimes. It is admitted that the present method of purifying the slimes is capable of much improvement, and it is intimated that an electrical process of handling them is being perfected. J. W. RICHARDS.

**Production of Gold in 1904.** BY T. A. RICKARD. *Eng. Min. J.*, January 5, 1905.—Of the $84,551,300 worth of gold mined in the United States in 1904, 30 per cent. came from Colorado, 22 per cent. from California, 10 per cent. from Alaska, 8 per cent. from South Dakota, 6 per cent. from Nevada, and 5 per cent. each from Utah and Nevada. Of the estimated $350,000,000 of the whole world, Australasia is credited with 25 per cent., United States 25 per cent., South Africa 23 per cent., Russia 7 per cent, Canada 5 per cent., and the rest scattering. J. W. RICHARDS.

**The Cyanide Process in the United States.** BY C. H. FULTON. *Eng. Min. J.*, January 5, 1905.—*Crushing of Ore.*—Crushing at once in cyanide solution is becoming standard practice in the Western States. At the Hidden Fortune mine in South Dakota the ore is stamped with 1.5 pounds solution, amalgamation being accomplished as usual both by chuck-blocks inside the mortars and by silvered copper plates outside; lime is added only to the pulp after amalgamation. Chilean mills are largely replacing stamps for the wet grinding. *Treatment of slime.*—The decantation process is still standard, but successful experiments with the filter-press methods point to their replacing the other. *Zinc precipitation.*—For large plants, the use of zinc dust is finding increased application. *Cyanide.*—Sodium cyanide is replacing the potassium salt or the mixed salts; it is purer, contains no soluble sulphides, is more soluble and acts quicker. *Electrical precipitation.* The Malm process, used at Marysville, Montana, uses electrodes of iron, coated on the anode side by graphite; current density 0.25 ampere per square foot of cathode; solution let stand in box 1.5 to 2 hours; deposit averages 51 per cent. of copper, 3.2 per cent. gold and silver, some arsenic, antimony and lead and considerable lime.

At the Butters plant at Virginia City, Nevada, a current density of 0.2 to 0.25 ampere per square foot of anode is used, with 3 volts between the electrodes; the anodes are 0.185 inch thick sheet lead, coated with lead peroxide by use as anodes in a 1 per cent. solution of potassium permanganate, using for this a current density of 1 ampere per square foot. The cathodes are tin plate, on which the gold deposits as mud, and is scraped off or falls to the bottom of the tank; 216 tons of solution pass in twenty-four hours over 6950 square feet of anode. The electrodes are both practically indestructible. J. W. RICHARDS.

**A Slate-green Finish on Silver.** BY C. H. POLAND. *Brass World*, February, 1905.—One and a quarter ounces of iodine and a similar weight of potassium iodide are dissolved in half a pint of hot water, and made up to a gallon; best in a porcelain dish. The solution is used hot, nearly boiling. The solid silver or silver-plated ware is buffed, grease removed by soap, then dipped in hot caustic, rinsed, given a dip in a cyanide bath, rinsed, and then immersed in the hot, iodine solution, being kept in motion. The color changes to gray, then darker, then a uniform green, in about two minutes. Rinse in water and dry with a soft cloth; the color is slate-green, like enamel. J. W. RICHARDS.

**American Tin Deposits.** BY J. STRUTHERS. *Iron Age*, December 8, 1904 (from *Bull. U. S. Geol. Survey*).—Ten companies are now employed in de-tinning tin-scrap in the United States, but no reduction of tin ores is being operated. The Harvey Peak region in Dakota yields ore averaging 1 per cent. of tin, but has so far not been economically worked. The Alaska deposits are not yet of commercial importance, although very promising. The Carolina tin belt from Gaffney, S. C., to Rockbridge Co., Va., has ores averaging 1.5 per cent. of tin, but so far these have not been economically handled, although quite as rich as the average tin ores of Saxony. The United States consumes some 43 per cent. of the world's production of tin, which was, in 1903, 93,893 gross tons, of which 54,797 tons came from the Malay States, 20,060 tons from Banka, 9,500 tons from Bolivia, 4,150 tons from Cornwall, and 4,491 tons from Australia. J. W. RICHARDS.

**A Process of Reducing Aluminium.** BY H. S. BLACKMORE. *Electrochem. and Metal. Ind.*, January, 1905.—A proposition to melt together 4 parts of lithium oxide and 1 of calcium oxide, which melted mixture is said to dissolve 60 per cent. of its weight of alumina, without forming aluminates, and the bath can be then electrolyzed and aluminium continuously extracted without decomposing the other oxides. No one will believe that lithium oxide would not be first decomposed by the current, until the fact is proved, because from all that we at present know, lithium oxide is a weaker material than alumina. J. W. RICHARDS.

**Resistance Furnaces for Crucibles.** By F. A. J. Fitz Gerald. *Electrochem. and Metal. Ind.*, February, 1905.—Some very practical instructions for the construction of small crucible furnaces, in which the crucible is embedded in a granular resistance material, and can be heated up to any temperature, which it will stand. Such furnaces are very convenient for metallurgical experiments, and indeed, for melting metals commercially where power is cheap and exact regulation of temperature and absence of reducing gases or impurity from fuel are desirable. J. W. Richards.

**Refractory Materials in Electrical Resistance Furnaces.** By F. A. J. Fitz Gerald. *Electrochem. Industry*, November, 1904.—A review of the manufacture of siloxicon. A small box was lined with siloxicon tiles, filled with granular coke, and heated by by the electric current. At a bright, red heat the carbon was raked out, and the resistance of the empty box determined. It was found that the resistance of the lining was about 6 per cent. of that of the whole furnace, showing that 6 per cent. of the current would be leaking from the granular material to the lining. In carborundum tiles the leakage is somewhat greater. If the temperature is so high that carborundum is decomposed, carbon alone can be used. J. W. Richards.

**Materials for Resistors in Electric Furnaces.** By F. A. J. Fitz Gerald. *Electrochem. Industry*, December, 1904.—Carbon, either solid or granulated, is the only practical material for high-temperature electric furnaces. When cold, carbon as graphite is four times as conducting as amorphous carbon; when hot, the graphite is 25 per cent. poorer conductor than when cold, the amorphous carbon 2 times better than when cold. In running an electric furnace, the maximum power is usually wished to be used as steadily as possible all through the run; to accomplish this end, the maximum and minimum voltages at one's disposal must be to each other in the ratio of the square roots of the maximum and minimum resistances of the resistor in the furnace.

J. W. Richards.

## ORGANIC CHEMISTRY.

**On the Behavior of Tetrabrom-o-Benzoquinone toward Ketones and Aldehydes.** By C. Loring Jackson and F. W. Russe. *Ber. chem. Ges.*, 38, 419-421.—Tetrabrom-*o*-benzoquinone reacts with compounds containing the keto group. The course of the reaction was studied with 5 ketones and 2 aldehydes, and it was found that the same three substances resulted in every case, *viz.*, hexabrom-*o*-quinone catechol ether $C_6Br_4O_2.C_6Br_2O_2$, its reduction-product, hexabromdioxycatechol ether, $C_6Br_4O_2.C_6Br_2(OH)_2$, and a heptabrom-*o*-quinone catechol hemiether, $C_6Br_4(OH).O.C_6Br_3O_2$. The latter is best obtained by mixing 1 gram

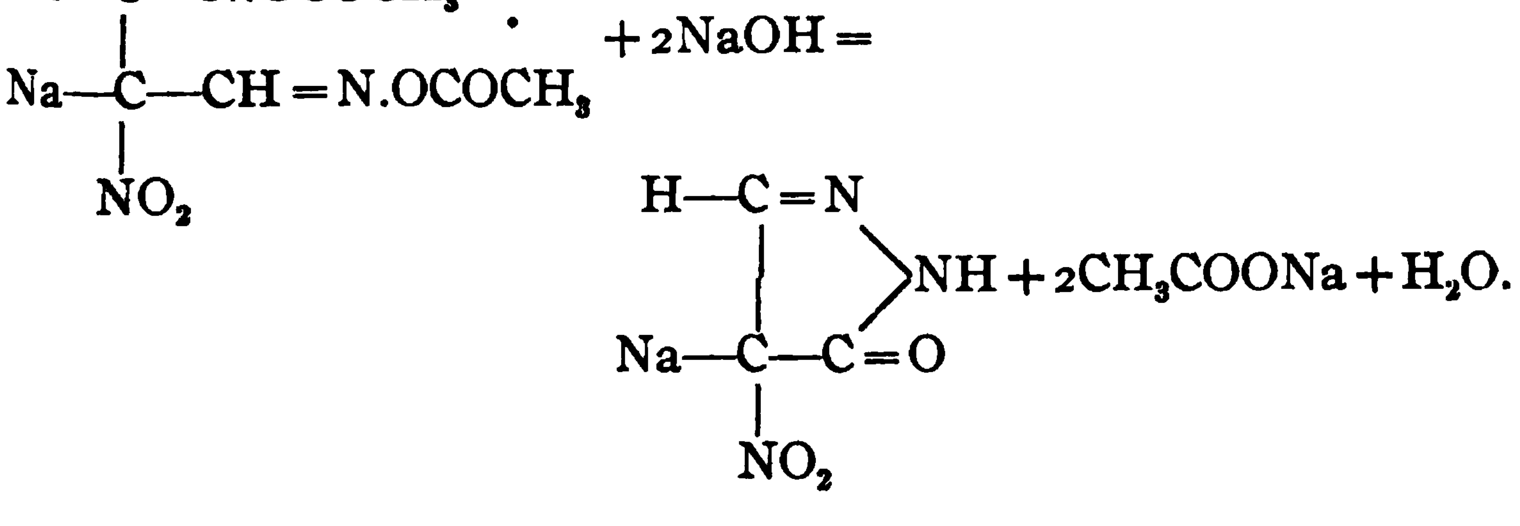
of the quinone, 0.5 cc. of pure acetone and 5 cc. of dry benzene, leaving the mixture for two weeks in a sealed vessel at ordinary temperature, and then recrystallizing from benzene, the yield being about 70 per cent. of the theoretical. It crystallizes from benzene in large, yellow prisms, containing 1.5 molecules of benzene, which is lost on standing in the air. By warming its alcoholic solution, or by the action of acetic anhydride, it is changed to the red hexabrom-*o*-quinone catechol ether, while zinc dust and acetic acid, or phenylhydrazine, change it to hexabromdioxycatechol ether. By treatment with acetone, both the above compounds may be obtained from it. In the preparation of the heptabrom compound from acetone (or acetophenone), some bromacetone (or ω-bromacetophenone) is formed.

M. T. BOGERT.

**On the Action of Potassium Iodide on Bromanil and Chloranil** (Preliminary Communication). BY HENRY A. TORREY AND W. H. HUNTER. *Ber. chem. Ges.*, **38**, 555-556.—When bromanil is heated with potassium iodide, in acetone solution, a *dibromdiiodbenzoquinone* is obtained, which crystallizes from ethyl acetate in reddish-brown prisms or golden-brown plates, beginning to sublime at about 240°, and melting at about 255°. Like other quinones, it forms addition-products with amines. The *addition-product with diphenylamine*, $C_6O_2Br_2I_2.(C_6H_5)_2NH$, forms beautiful dark red crystals, giving a green powder when pulverized. *o*-Toluidine gives a product of similar properties. The dibromdiiodbenzoquinone may be readily reduced to a colorless compound, which is probably the corresponding hydroquinone. Chloranil, partly dissolved in acetone, is readily attacked, even in the cold, by finely pulverized potassium iodide, giving a green substance which contains potassium, and is immediately decomposed by water with separation of a light-yellow, insoluble substance, and formation of a purple solution. Bromanil, under similar conditions, gives a similar derivative.

M. T. BOGERT.

**On 4-Nitro-5-Pyrazolone.** BY H. B. HILL AND O. F. BLACK. *Am. Chem. J.*, **33**, 292-300.—When nitromalonic diacetyldialdoxime is dissolved in a hot, caustic soda solution, the sodium salt of 4-nitro-5-pyrazolone is formed, probably according to the following equation:



Its sodium, silver, lead and barium salts were prepared and analyzed. By the action of a current of air loaded with bromine vapor on the aqueous solution of the sodium salt, tribrompyrazole was obtained, $N{=}CBr.CBr : CBr.NH$, and a small amount of another *substance*, not thoroughly identified, but apparently a dibromnitropyrazole. By the action of phosphorus oxychloride upon the sodium salt of the nitropyrazolone at 100°, in a sealed tube, 4-nitro-5-chlorpyrazole was produced. EXPERIMENTAL. *Preparation of Sodium Nitromalonic Diacetyldialdoxime.*—Hydroxylamine hydrochloride was dissolved in caustic soda solution, the sodium salt of nitro-malonic aldehyde added, and the mixture allowed to stand until the sodium dialdoxime began to crystallize out. More caustic soda solution was then added, the solution diluted, cooled with ice water, and acetic anhydride added in small amounts with shaking. The sodium salt of the diacetyl oxime separates as a light-yellow crystalline precipitate, which can be filtered out, washed and dried. *Sodium 4-Nitro-5-pyrazolone* was prepared by adding dry sodium nitromalonic diacetyldialdoxime to a warm solution of two molecules of caustic soda, and concentrating the resulting bright red solution on the water-bath to half its volume. On cooling, the new salt crystallizes out in a mass of fine orange-yellow needles, to which a small amount of sodium acetate clings tenaciously. The pure sodium salt is best made by neutralizing the pure pyrazolone with sodium hydroxide. It crystallizes with three molecules of water, two of which are given off on exposure to the air. By spontaneous evaporation of its aqueous solution, it is obtained in dark red prisms. Reduced with sodium amalgam, the solution turns purple in the air. *4-Nitro-5-pyrazolone* was obtained by adding hydrochloric acid to the aqueo s solution of the sodium salt, extracting with ether, and precipitating the ethereal solution by the addition of ligroin. It forms small, colorless crystals, m. p. 136°-137°, soluble in water, alcohol or ether, less soluble in benzene, chloroform or ligroin. *Silver salt*, $C_3H_2O_3N_3Ag$, reddish-yellow powder, insoluble in water. *Barium salt*, $(C_3H_2O_3N_3)_2Ba.4H_2O$; dark-red, efflorescent needles, somewhat less soluble in water than the sodium salt. *Lead salt*, $(C_3H_2O_3N_3)_2Pb$, yellow powder, only slightly soluble in hot water. *Acetyl derivative*, small colorless prisms, m. p. 129°. *4-Nitro-5-chlorpyrazole*, from the sodium salt of the nitropyrazolone heated with excess of phosphorus oxychloride in a sealed tube at 100°, crystallizes in fine, white needles, m. p. 186°-187°, and exhibits the properties recorded for this substance by Meder. *Tribrompyrazole*, $C_3HN_2Br_3$, is best prepared as follows: The sodium salt of the nitropyrazolone is dissolved in strong hydrobromic acid, an excess of bromine added, and the mixture heated in a sealed tube for two or three hours at 100°. The product is washed with cold water, distilled with steam, and dried *in vacuo*. It forms silky, white

needles, which sublime at about 129°, and melt at 181°. It is soluble in alcohol or ether, sparingly soluble in hot water, and is volatile with steam. It dissolves in caustic soda solution, and is reprecipitated by acids. Reduced with sodium amalgam, the solution turns purple in the air. *Silver salt*, $C_3N_2Br_3Ag$, white, crystalline powder, insoluble in hot water, and very stable, not being completely decomposed when heated to 300° with fuming nitric acid. *Acetyl derivative*, white needles (from alcohol), m. p. 105°-106°. *Secondary product* formed in making tribrompyrazole. On concentrating the mother-liquors from the tribrompyrazole, when the latter was prepared by the action of bromine vapor upon the sodium salt of the nitropyrazolone, a new substance was obtained crystallizing in white needles, m. p. 163°-164°, and apparently a dibromnitropyrazole. With bromine it gave an orange crystalline addition product; with acetic anhydride and caustic soda, an acetyl derivative. The bromine addition-product was decomposed by boiling water, with regeneration of the original substance (m. p. 163°-164°) and liberation of bromine.

M. T. BOGERT.

**On the Composition of Petroleum.** BY CHARLES F. MABERY. *Am. Chem. J.*, 33, 251-292. **I. The Hydrocarbons in Ohio Trenton Limestone Petroleum.** BY CHARLES F. MABERY AND O. H. PALM. **II. The Hydrocarbons in Canadian Petroleum with High Boiling-points. III. Hydrocarbons in Santa Barbara Crude Oil. IV. Separation of Solid Paraffin Hydrocarbons from Petroleum without Distillation.** BY CHARLES F. MABERY AND OTTO J. SIEPLEIN. **V. The Solid Paraffin Hydrocarbons that Collect in Oil Wells in Pennsylvania. VI. Composition of Commercial Paraffin. VII. Composition of Commercial Vaseline, Cosmoline, and Similar Products.**—Previously published in *Proc. Am. Acad. Arts and Sci.*, 40, 323-362 (see this Journal, 27, R. 33-35, 1905). M. T. BOGERT.

**Correction Concerning Dimethyl- and Trimethyl-adipic Acids.** BY WILLIAM A. NOYES AND HOWARD W. DOUGHTY. *Ber. chem. Ges.*, 38, 947-950 (see this Journal, 27, 237-240), (1905).

M. T. BOGERT.

## BIOLOGICAL CHEMISTRY.

**On the Distribution of Potassium in Animal and Vegetable Cells.** BY A. B. MACCALLUM. *J. Physiol.*, 32, 95-129.—The hexanitrite of cobalt and sodium, $CoNa_3(NO_2)_6$, in solution and in the presence of sodium is an immediate precipitant for potassium from its solutions, the precipitate being an orange-yellow triple salt, which is the hexanitrite of cobalt, sodium and potassium, $CO\left(\begin{matrix}K_x\\Na_y\end{matrix}\right)_3(NO_2)_6$.

When the reagent is specially prepared it precipitates, as the triple salt, all the potassium from its solutions. For this purpose it is made by dissolving 20 grams of cobalt nitrate and 35 grams of sodium nitrite in 75 cc. of water, adding thereto 10 cc. glacial acetic acid and diluting the solution with water to 100 cc. When isolated cellular elements, or fresh tissues, very minutely teased out, are put in quantities in this reagent, the latter penetrates to all parts of these elements in a few seconds, and, in consequence, in that time precipitates all their potassium at points where its compounds occur. If these are abundant, as in some vegetable tissues, the precipitate is crystalline, but if they occur only in minute quantities, as is the case with all cytoplasmic structures, the precipitate is of such a character that its constituent particles are not individually visible. In order to determine the distribution of the precipitate in a preparation the latter must be washed thoroughly with ice-cold water to remove all traces of the precipitant, after which the triple salt formed and left behind will, if it is abundant, reveal itself under the microscope by its light orange-yellow color. To reveal the presence and distribution of the more minute quantities the preparation may be treated with ammonium sulphide solution, which gives the black cobaltous sulphide reaction wherever the triple salt is deposited, and thus the black reaction at any point is evidence of the presence there of potassium. Such preparations mounted in glycerine (50 per cent.) will keep for two months. As revealed by this method, potassium occurs in both the cytoplasmic and the extra-cellular structures, but the cell nucleus does not normally contain the slightest trace of potassium. Nerve cells are wholly free from potassium as are also the dendrites and axons. The potassium obtaining in cytoplasm occurs in two conditions, that of physiological precipitation and that of physiological or bio-chemical condensation. In smooth muscle fiber the potassium found is scant and it is diffused throughout its cytoplasm, but in striated fiber there is a condensation of the potassium in the dim bands, the rest of the fiber being free from the element. There is in the secreting cells of the pancreas of the guinea-pig and rabbit a remarkable concentration of potassium compounds in that portion of the granular zone immediately adjacent to the lumen, while the remainder of the cytoplasm is free from them. There are organisms which manifest a distinct capacity to absorb potassium and among them is one, parasitic on *spirogyra*, whose mycelial threads exhibit kaliophilism in a special degree. F. P. UNDERHILL.

**Effect on Blood-Pressure of Proteolytic Products.** BY C. G. L. WOLF. *J. Physiol.*, **32**, 171-175.—The object of the present experiments was to determine whether the simple cleavage products of proteid would call forth any of the effects, such as fall in arterial blood-pressure, characteristic of proteoses and peptones when in-

jected into the circulation of animals. Experiments were carried out with the following substances: Glycine, leucine, tyrosine, uracil, cytosin, indol, skatol, tryptophane, xanthine, hypoxanthine, guanine, thymine, glycine ethyl ester and $\alpha$-pyrrolidine carboxylic acid, $\alpha$-methyl-pyrrolidine carboxylic acid, arginine, glutaminic acid, glucothionic acid, and the four polypeptides, leucyl-glycine, leucyl-leucine, glycyl-asparagine, and alanyl-leucyl-glycine. In all cases, except one, the results were entirely negative. There was no effect upon arterial pressure, intestinal volume, respiration or rate of blood-clotting. The single exception was with glucothionic acid and the effect of this substance was to cause a rise of blood-pressure together with a slightly decreased clotting time of the blood. F. P. UNDERHILL.

**Further Observations on the Catalytic Decomposition of Hydrogen Peroxide.** BY A. S. LOEVENHART. *Am. J. Physiol.*, 13, 171-186.—When unneutralized commercial hydrogen peroxide is used it is found that pancreas extract markedly accelerates the decomposition of the peroxide by liver extract. Muscle extract has the same accelerating action. The accelerating action of the pancreas is not destroyed by boiling. Boiled and fresh liver extract greatly accelerated the decomposition of hydrogen peroxide by fresh liver extract. When neutralized hydrogen peroxide is employed none of these accelerations are noted, and the accelerating action of these extracts is due to the fact that they neutralize the retarding action of the acid contained in the commercial peroxide. Acids inhibit the action of the pancreas extract relatively much less than they do that of liver extract, and hence the action of pancreas extract on the acid hydrogen peroxide is not so greatly accelerated by boiled or fresh liver or pancreas extract. On the other hand, sodium thiosulphate and thiourea accelerate the action of liver extract more than they do that of the pancreas extract. Temperature, however, affects the activity of liver and pancreas alike, and the differences observed are probably due to differences in the environment of the catalase in the liver and pancreas, the enzymes being probably identical.

F. P. UNDERHILL.

**Twitchings of Skeletal Muscles Produced by Salt Solutions with Special Reference to Twitchings of Mammalian Muscles.** BY WALTER E. GARRY. *Am. J. Physiol.*, 13, 186-192.—The results of a continuation of the investigations begun by Loeb and the author on muscular contractions produced by immersion in various salt solutions. F. P. UNDERHILL.

**The Role of Certain Ions in Rhythmic Heart Activity.** BY STANLEY R. BENEDICT. *Am. J. Physiol.*, 13, 192-205.—Benedict presents a theory for the action of certain salts in inducing rhyth-

mic heart beats, which coincides in general with that formulated recently by Mathews for the action of salts upon nerve tissue.

F. P. UNDERHILL.

**On Errors of Eccentricity in the Human Eye.** BY CHARLES S. HASTINGS. *Am. J. Physiol.*, **13**, 304-309.—The author shows that Helmholtz's statement that the human eye is not accurately centered is incorrect. F. P. UNDERHILL.

**The Effect of Pigment-migration on the Phototropism of Gammarus Annulatus S. I. Smith.** BY GRANT SMITH. *Am. J. Physiol.*, **13**, 205-217.—In *Gammarus annulatus* the retinal pigment in the "dark" eye is accumulated in the distal and the proximal ends of the retinular cells and leaves the rhabdome exposed to the reflecting action of the accessory pigment. In the "light" eye the rhabdome is ensheathed by the retinal pigment, and the accessory pigment can no longer act as a reflector. The migration of the pigment from the condition in the "dark" eye to that in the "light" eye is rapid during the first fifteen minutes of exposure to light, and then slower till its completion, which occurs in about an hour. *Gammarus annulatus* when taken from the dark and exposed to a constant light of 30 to 110 candle-meters in intensity is, during the first ten minutes, either indifferent, slightly negative or slightly positive phototropic. This condition rapidly gives way to a strongly positive phototropism, which gradually increases in the course of an hour or so, to a maximum. The retinal pigment-migration, since it controls the amount of light reaching the rhabdomes, is in all probability the means of inducing this change in phototropism. F. P. UNDERHILL.

**The Osmotic Pressure of Sea-Water and of the Blood of Marine Animals.** BY WALTER E. GARRY. *Biol. Bull.*, **8**, 257-270.—The sea-water at Wood's Hole, Mass., freezes at $-1.82°$ C., at Pacific Grove., Cal., $\Delta$ is $-1.90°$ C. The blood or body fluid of a marine invertebrate has the same freezing-point as the sea-water from which it is taken, and therefore has the same osmotic pressure. This is also true of selachian blood, although the salt content is lower than that of the sea-water, the deficit of salts in the blood of this latter group is compensated by the osmotic pressure of the urea in the blood. The osmotic pressure of teleost blood is about half that of the sea-water. A dilution or concentration of the aquarium water always causes an equivalent change in the blood of invertebrates, and osmotic equilibrium between the "internal and external media" is established. Their membranes are completely permeable. Dilution or concentration of the aquarium water causes a change in the same sense in the blood of selachians, but death ensues before osmotic equilibrium is established. The membranes of selachians are semi-permeable. Only slight, if any, change takes place when teleosts are transferred

from salt to fresh water and *vice versa*. The membranes of teleosts are impermeable or the fish possesses some regulative mechanism which keeps the osmotic pressure of the blood nearly constant. Extensive abrasion of the skin of *Fundulus* results in death in aquarium water of less or greater osmotic pressure than that of their blood. F. P. UNDERHILL.

**The Dietetic Use of Predigested Legume Flour, Particularly in Atrophic Infants.** BY DAVID L. EDSALL AND CASPAR W. MILLER. *Am. J. Med. Sci.*, **129**, 663-684.—Bean flour in which the starch is predigested by means of a diastatic ferment seems to be well digested and absorbed by infants and adults. An extremely concentrated food may be given in this way in fluid and partially digested form; a 20 per cent. solution is practically equivalent to beefsteak in nutritive value. Its influence upon the digestive tracts in infants in the cases studied was usually distinctly favorable, and its influence upon metabolism in infants and adults is at least equal to that of milk. F. P. UNDERHILL.

**Food Preservatives and Food Adulterations.** BY HARVEY W. WILEY. *N. Y. and Phila. Med. J.*, **81**, 692-694.
F. P. UNDERHILL.

**A Modification of the Heller Test for Albumin in the Urine.** BY ABBOTT SMITH PAYNE. *Med. Record*, **67**, 538.—The modification of the Heller test for albumin in the urine consists in heating the urine after addition of acid without disturbing the line of contact between the two fluids. By this means proteid, if present, is much more easily seen, especially if viewed against a dark background. F. P. UNDERHILL.

**Some Further Observations on Leucocytotoxins.** BY HENRY A. CHRISTIAN AND THOMAS F. LEEN. *Boston Med. and Surg. J.*, **152**, 397-398.—These experiments show the ease with which leucocytoxines can be produced by the injection of a variety of somatic cells as those of the spleen, liver, kidney and cardiac muscle. Leucocytotoxic sera so produced are also haemolytic and the specificity of such sera is analogous to that of haemolytic sera. Cultures in bouillon of various bacteria contained no substance which was cytotoxic for the leucocytes of the guinea-pig when tested by this method. F. P. UNDERHILL.

**The Coagulation of the Blood.** BY LEO LOEB. *Med. News*, **86**, 577-585.—A résumé of the recent work on the phenomena connected with blood coagulation of vertebrates and invertebrates carried out by the author and others, together with a discussion of the theory of blood coagulation. F. P. UNDERHILL.

**Investigations on Blood Coagulation.** BY LEO LOEB. *Beiträge z. chem. Physiol. u. Pathol.*, **6**, 233-260.—A continuation

of the author's investigations on the coagulation of blood of the invertebrates. F. P. UNDERHILL.

**On Adenase.** BY WALTER JONES AND M. C. WINTERNITZ. *Ztschr. physiol. Chem.*, **44**, 1-11.—Guanine is not changed when subjected to the influence of a spleen infusion, and may be regained after the digestion. According to this behavior the spleen contains no noteworthy quantities of guanase. In the self-digestion of an aqueous spleen infusion hypoxanthine quickly makes its appearance. By continued digestion xanthine appears in small amount and its quantity increases at the expense of the hypoxanthine if the digestion is allowed to continue. Addition of adenine to an aqueous extract of the spleen results in a complete transformation of the adenine into hypoxanthine, or else into a mixture of xanthine and hypoxanthine, according to the duration of the digestion. Thus oxidase is present in the spleen in small amount, and the xanthine formed by the long-continued autolysis of the gland is to be ascribed to the adenine and not to guanine. In the self-digestion of the liver are found guanine, a trace of hypoxanthine and a considerable quantity of xanthine. Guanine added to a liver infusion can be regained unchanged, so the gland cannot contain significant quantities of guanase. Adenine when added to a liver digestion is quickly transformed into xanthine. The distribution of the ferments in the liver is identical with that in the spleen, except that in the former the oxidase is present in much greater concentration than is true in the latter.

F. P. UNDERHILL.

**A Method for the Rapid Determination of Chlorine in the Urine.** BY WILLIAM M. DEHN. *Ztschr. physiol. Chem.*, **44**, 11-17.—Into a casserole of 50 to 100 cc. capacity are measured 10 cc. of urine and a spoonful of sodium peroxide (free from chlorine). After stirring, the mixture is concentrated on the water-bath. The vessel is removed from the bath and 10 cc. of water and enough dilute nitric acid are added to give a significant acid reaction to litmus. A little iron nitrate is added to serve as an indicator and the mixture is titrated with potassium sulphocyanate and silver nitrate, according to the method of Volhard.

F. P. UNDERHILL.

**Perfusion Experiments on Excised Kidneys. I. General Methods.** BY TORALD SOLLMANN. *Am. J. Physiol.*, **13**, 241-253.—Excised kidneys perfused with saline solutions under a moderate pressure yield a plentiful vein and ureter flow. The ureter flow is not formed by the rupture of the vessels. While the functions of the kidney are disturbed by excision some degree of vital action on the part of the epithelium and of the vessels persists for twenty to twenty-four hours after incision. The formation of the ureter fluid during perfusion with saline solutions is mainly, if not en-

tirely, due to filtration. The circulation and filtration phenomena in the excised kidney undergo slow but distinct changes even when the conditions are kept constant. These are explained hy the gradual development of an obstruction to the circulation, occurring about the level of the efferent arteries, the post-mortem coagulation of the epithelium constituting the filtering membrane, introducing a gradually increasing resistance of filtration, and a gradual post-mortem dilatation of the renal vessels.

F. P. UNDERHILL.

**Perfusion Experiments on Excised Kidneys. II. The Effects of Changes in the Arterial, Venous and Ureter Pressure.** BY TORALD SOLLMANN. *Am. J. Physiol.*, 13, 253–278.—Excised kidneys perfused with saline solutions show that the vein flow, ureter flow, oncometer, maximal vein pressure, and maximal ureter pressure, all vary in the same direction as the injection pressure. Rhythmically intermittent pressure gives a better vein and ureter flow than the same mean constant pressure. Obstruction of the vein causes a swelling of the kidney and an almost complete abolition of the ureter flow. There is a close qualitative correspondence between the phenomena observed in the living kidneys in the body and the mechanical filtration phenomena in the excised kidney.

F. P. UNDERHILL.

**Perfusion Experiments on Excised Kidneys. III. Anisotonic Solutions.** BY TORALD SOLLMANN. *Am. J. Physiol.*, 13, 278-286.—The vein and ureter flow in the excised kidneys vary with the molecular concentration of the perfusion fluid. The results occur with even slight changes of concentration, and may be elicited from kidneys that have lain a day, and also on perfusion with alcohol. The results are brought about by a shrinkage or swelling of the renal cells. The effect of the molecular concentration of the circulating fluid is in entire accord in the dead kidney and in the living animals.

F. P. UNDERHILL.

**Perfusion Experiments on Excised Kidneys. IV. Solutions of Non-Electrolytes.** BY TORALD SOLLMANN. *Am. J. Physiol.*, 13, 286-289.—Solutions of urea and alcohol of the same freezing-point as 1 per cent. sodium chloride act like strongly hypoisotonic solutions, penetrating freely into the renal cells. This permeability is not absolute. Isotonic solutions of dextrose and cane-sugar cause only small and somewhat variable changes, which can, for the most part, be ascribed to viscidity.

F. P. UNDERHILL.

**Perfusion Experiments on Excised Kidneys. V. The Effect of Viscidity.** BY TORALD SOLLMANN. *Am. J. Physiol.*, 13, 289–291.—Viscidity, induced by egg albumen or acacia, causes a

diminution in the vein and ureter flow, and in the volume of the kidney. F. P. UNDERHILL.

**Perfusion Experiments on Excised Kidneys. VI. The Action of Blood on the Kidney.** BY TORALD SOLLMANN. *Am. J. Physiol.*, 13, 291-305.—The general conclusions of this investigation are that blood has a dilator effect when perfused into excised kidneys, and that the phenomena of saline diuresis can be reproduced in an excised kidney, and that the phenomena can be explained by the diminished viscidity of the blood, accompanying hydraemia. F. P. UNDERHILL.

**The Determination of Water in Foods and Physiological Preparations.** BY FRANCIS G. BENEDICT AND CHARLOTTE R. MANNING. *Am. J. Physiol.*, 13, 309-330.—Since at present there is no accurate method for the determination of water in all kinds of substances the authors give such a method. It depends upon the principle of desiccation of the substances in a partial vacuum. Numerous tables are given showing the results that may be obtained with all kinds of foods and physiological preparations.
F. P. UNDERHILL.

**On Bilirubin, the Red Coloring-Matter of the Bile.** BY W. R. ORNDORFF AND J. E. TEEPLE. *Am. Chem. J.*, 33, 215-250.—See also *Festschrift* für Salkowski and abstract this Review for July.
F. P. UNDERHILL.

## SANITARY CHEMISTRY.

**Effect of Temperature on Bacteria of Milk.** BY H. W. CONN AND W. M. ESTEN. *Report Storrs Agr. Expt. Sta., 1904*, p. 27.—The object of these experiments was (1) "to extend the observations of the effect of temperature upon the species of bacteria which grow in milk and (2) to determine whether there is any regularity in the results."

Fresh milk containing no more than 20,000 bacteria per cubic centimeter was used, and divided into lots. These were placed at different temperatures, *e. g.*, 1° C., 10° C., 20° C., 37° C., and samples taken from time to time for bacteriological analysis, which samples were so diluted as to show from 200 to 500 colonies on each plate. So far as possible, by means of a hand lens and a low-power microscope, the colonies were differentiated from each other, about ten groups being thus distinguished, estimated and described.

Nine different series of experiments are reported. Results show that "the effect of variations of temperature upon the development of the different species of bacteria in milk is not always the same under apparently identical conditions." This is due, prob-

ably, to the presence, at the outset, of an especially persistent species.

The development of the ordinary lactic species (*Bact. lactis acidi*) checks the growth of other species and finally destroys them, thus serving as a protection to persons drinking milk, for the presence of large numbers of lactic bacteria does not indicate that the milk is deleterious.

At 20° C. the lactic bacteria grow so rapidly that in forty hours the milk curdles, 90 per cent. of the bacteria being *B. lactis acidi.*

At 37° C., the results are not so uniform as at 20°. Sometimes *Bact. lactis acidi* predominates, but generally, the gas producer *B. lactis aerogenes* grows most vigorously. Milk sours very rapidly at this temperature.

At 10° C., the lactic bacteria are not favored, and so do not check the growth of other groups, all types growing more or less uniformly. Therefore, at this temperature, milk will in time become decidedly affected by bacteria, and its wholesomeness will become suspicious.

At 1° C., the same results are shown as at 10° except that bacteria grow much less rapidly. Curdling is not dependent upon the number of bacteria.

At 37°, one sample curdled which contained only 8,000,000 colonies per cubic centimeter, while other samples contained as much as 4,000,000,000 per cubic centimeter without curdling.

If milk be kept at low temperatures, it is not necessarily wholesome because it is sweet, for at this temperature the lactic bacteria do not grow rapidly enough to check and destroy other and more injurious types. J. A. LeClerc.

**Experiments on the Digestibility of Cereal Breakfast Foods.** By W. O. Atwater, H. C. Sherman and R. D. Milner. *Report Storrs Agr. Expt. Station, 1904,* p. 180.—Nine experiments with three different kinds of breakfast foods, grape nuts, malta vita, and force, were undertaken, the diet consisting of breakfast food, milk, cream and sugar. The food consumed and feces excreted were all analyzed. The experiments, as a rule, lasted three or four days. Tables showing amounts of materials consumed, amount of feces excreted, their analyses, heats of combustion and coefficient of digestibility and the method of calculating the available energy are given. With all of the six subjects, the diet became decidedly monotonous and disagreeable before the end of the experiment.

The following table shows the availability of nutrients and energy of the total diet, compared with corresponding results obtained with other cereal foods.

| Cereal part of diet. | Total organic matter. Per cent. | Protein. Per cent. | Fat. Per cent. | Carbohydrates. Per cent. | Energy. Per cent. |
|---|---|---|---|---|---|
| Grape nuts......... | 94.0 | 87.3 | 96.2 | 94.4 | 90.7 |
| Malta vita......... | 92.9 | 86.9 | 95.6 | 93.1 | 89.8 |
| Force............. | 92.2 | 88.6 | 90.7 | 93.9 | 86.8 |
| Graham bread...... | 92.2 | 89.8 | 94.5 | 92.3 | 87.6 |
| Entire wheat bread. | 94.8 | 92.0 | 95.8 | 95.4 | 89.8 |
| White bread....... | 97.0 | 94.2 | 96.3 | 97.9 | 91.6 |

Table 89 shows availability of nutrients and energy of cereal food materials alone.

| Cereal food. | Protein. | Carbohydrate. | Energy. |
|---|---|---|---|
| Grape nuts............. | 70.1 | 91.5 | 86.3 |
| Malta vita............. | 72.1 | 90.0 | 83.4 |
| Force.................. | 69.8 | 88.5 | 78.7 |
| Graham bread.......... | 76.0 | 90.4 | 82.9 |
| Entire wheat bread..... | 82.3 | 94.1 | 87.1 |
| White bread............ | 88.1 | 97.9 | 92.0 |

J. A. LeClerc.

**Standards of Purity for Fermented and Distilled Liquors.** By Philip Schidrowitz. *J. Soc. Chem. Ind.*, 24, 176 (1905).—The author considers two factors in the food problem, *viz.*, adulteration and misrepresentation, and takes as the basis of his remarks the suggestions to importers made in Circular No. 18, Bureau of Chemistry, Department of Agriculture. The limit of 20 mg. per liter of free sulphurous acid in wines is considered somewhat low, especially for some of the heavier sweet wines where 30 to 40 mg. would not be excessive, while the maximum of 14 per cent. alcohol by volume for non-fortified wines would exclude many natural wines such as the heavier Burgundies, Spanish and Italian wines. In regard to brandy and whiskey, the author disagrees with the statement of Dr. Wiley that the object of storage in wood is the elimination of the fusel oil, and asserts that mature spirits generally contain more of the higher alcohols than do raw spirits. The addition of caramel is considered justifiable in the case of well-aged whiskey that has been stored in "plain" wood, and the author explains that in Scotland it is customary to store whiskey in sherry casks. Of late, however, the demand for sherry casks has been too great, and the distiller is obliged to use "plain" wood, with the result that even a well-aged whiskey would be of too low color. On the other hand, the addition of caramel to give fictitious appearance of age should be considered an adulteration.

The adoption of a single analytical factor as a standard of purity of any article is not considered advisable, owing to the ease with which such a factor may generally be fixed up to come within requirements. On the other hand, in case of fermented and distilled liquors complete analysis would frequently give necessary

information, although in many cases, the opinion of a taster is highly desirable. L. S. MUNSON.

**Copper as an Algicide and Disinfectant in Water Supplies.** GEORGE T. MOORE AND KARL F. KELLERMAN, *U. S. Department of Agriculture, Bureau of Plant Industry, Bulletin 76.*—The Bulletin gives an account of experiments and practical results obtained by the use of copper sulphate since the publication of Bulletin 64. "A Method of Destroying or Preventing the Growth of Algae and Certain Pathogenic Bacteria in Water Supplies." Abstract this Journal, **26**, R. 459-462.

During the summer of 1904 over fifty reservoirs were successfully treated to eradicate algae, and an alphabetical list of twenty-six cities and towns is given where the reservoirs were treated, with a résumé of the reports received from these towns and cities. The amount of copper sulphate required to remove algae is found to be less than that given in Bulletin 64, and the revised amount is as follows

NUMBER OF PARTS OF WATER TO ONE PART OF COPPER SULPHATE.

| | | | |
|---|---|---|---|
| Aphanizomenon | 5,000,000 | Microcystis | 1,000,000 |
| Anabaena circinalis | 10,000,000 | Navicula | 15,000,000 |
| Anabaena flos-aquae | 10,000,000 | Nitella | 10,000,000 |
| Asterionella | 8,000,000 | Oscillatoria | 5,000,000 |
| Beggiatoa | 100,000 | Palmella | 500,000 |
| Cladophora | 1,000,000 | Pandorina | 100,000 |
| Chlamydomonas | 1,000,000 | Peridinium | 450,000 |
| Clathrocystis | 8,000,000 | Raphidium | 300,000 |
| Closterium | 6,000,000 | Scenedesmus | 1,000,000 |
| Coelosphaerium | 3,000,000 | Spirogyra | 25,000,000 |
| Conferva bombycinum | 3,000,000 | Stigeoclonium | 3,000,000 |
| Crenothrix | 1,000,000 | Stephanodiscus | 250,000 |
| Desmidium | 450,000 | Synedra | 600,000 |
| Draparnaldia | 3,000,000 | Synura | 3,000,000 |
| Eudorina | 100,000 | Tabellaria | 600,000 |
| Euglena | 1,500,000 | Ulothrix | 5,000,000 |
| Fragilaria | 4,000,000 | Uroglena | 20,000,000 |
| Glenodinium | 2,000,000 | Volvox | 4,000,000 |
| Hydrodictyon | 10,000,000 | Zygnema | 2,000,000 |
| Mallomonas | 500,000 | | |

SALT WATER FORMS.

| | | | |
|---|---|---|---|
| Clapohora | 5,000,000 | Ulva | 5,000,000 |
| Enteromorpha | 10,000,000 | | |

The above amounts should be increased or decreased approximately by 2.5 per cent. for each degree below or above 15° centigrade and though there also must be an increase for waters con-

taining organic matter, and having a high temporary hardness, sufficient data have not been obtained to determine the exact amounts, probably 2 per cent. for each part of organic matter, and from 0.5 to 5 per cent. for each part of temporary hardness per 100,000 parts of water, depending on whether the carbon dioxide dissolved in the water is large or small. A few new data of the effect of copper sulphate on fish are also given, the results being as follows:

NUMBER OF PARTS OF WATER TO ONE PART OF COPPER SULPHATE IN DILUTION WHICH WILL NOT INJURE FISHES OF CERTAIN SPECIES.

| | | | | | |
|---|---|---|---|---|---|
| Trout | 7,000,000 | Salmon | 6,000,000 | Carp | 3,000,000 |
| Suckers | 3,000,000 | Cat-fish | 2,500,000 | Gold-fish | 2,000,000 |
| Perch | 1,500,000 | Sun-fish | 750,000 | Black Bass | 500,000 |

The most interesting part of the Bulletin is that which deals with the action of copper sulphate and metallic copper on the typhoid bacillus. A report of Dr. Kendric Smith, health officer of Columbus, Ohio, and a short report made by Mr. John Weinzert, city chemist of Albuquerque, New Mexico, are given. The first shows the successful application of copper sulphate to the city water of Columbus, Ohio, in removing *Bacillus coli*, and the lowering of the death-rate from typhoid fever; the second, the possible ending of an epidemic by its use in the city water supply. An account is also given of an interesting experiment made at the mechanical water filter plant at Anderson, Ind. When alum, even up to 3 grains per gallon, or pure iron sulphate, 3 grains per gallon, or 3 grains of iron sulphate and 1 grain of lime were used, *Bacilli coli* were usually present in 1 cc. of the filtered water. When 3 grains of iron sulphate containing 1 per cent. copper sulphate were used *Bacilli coli* were not found in 1 cc. of the filtered water, and this was also true, with 1.5 grains iron sulphate containing 1 per cent. copper sulphate and 2 grains of lime per gallon, in twenty-eight filtrates out of twenty-nine tested, and the one case where *Bacilli coli* were found occurred immediately after a leak, which allowed some unfiltered water to pass into the filtrate. With the same amount of iron sulphate and lime, but the iron sulphate only containing 0.5 per cent. copper sulphate, *Bacilli coli* were eliminated during the two days this mixture was used. When only 0.25 per cent. of copper sulphate was used *Bacilli coli* appeared in the filtrate. As regards the sterilization of bacteria in polluted waters the authors state: "Treatment with copper sulphate is an effective and practicable means of sterilizing water polluted with certain pathogenic bacteria, and as an emergency method is applicable to both household and municipal conditions. It should prove particularly useful in very large water supplies accidentally or suddenly contaminated with typhoid bacilli, and not provided with any adequate means of purifica-

tion. Under such circumstances, the case becomes not one of pure water *versus* water containing copper sulphate, but of sterile water containing an amount of copper not dangerous to health *versus* water and typhoid bacilli. The method formerly suggested for treating a reservoir would undoubtedly be advisable in special cases of unusually great contamination, when the water contained an abnormal amount of organic matter, but in general, an epidemic could be controlled and quickly eradicated by a solution much weaker than the 1 to 100,000 listed as necessary for complete sterilization within twelve hours. One to 2,000,000 is sufficient in most cases, and even less than this quantity of copper is of decided benefit in certain kinds of water." "At the present time the only known method of immediately rendering a contaminated water supply safe, and keeping it so, until the source of pollution is removed, seems to be the use of copper. This treatment is not designed to supplant efficient filtration, however, and should never be expected to take its place. The use of copper for removing a temporary contamination is necessarily a remedy, and should be used as such. As much care is demanded of the sanitary engineer or biologist in determining the necessity for treatment and the proper quantity to be used, as is demanded of a doctor in determining the dose for a sick person. A pure water should not be treated, just as a well person should not take medicine," and as regards sterilization by means of metallic copper, the authors say "the effect of metallic copper upon the typhoid bacillus in water is of considerable importance. For small amounts of water, it has been found convenient and desirable in many cases to guard against bacterial contamination by employing copper tanks, and where frequent boiling cannot be resorted to, the use of copper may be regarded as the only possible safeguard. In some cases this may not be absolute, for our experiments upon water from various places, and the experiments of other investigators show that the chemical constitution of the water under consideration is of the greatest importance. Water that contains a very large amount of matter in suspension is perhaps the most difficult to sterilize. Under these conditions, twenty-four to forty-eight hours at room temperature would probably be necessary for complete sterilization through the agency of metallic copper tanks; on the other hand, metallic copper in water containing a large amount of organic acid, or free acid of any sort, would destroy all typhoid bacilli in two or three hours at the most." As regards the harmlessness of small amounts of copper sulphate and its medical value in cases of typhoid fever and relative diseases, various authorities are cited and abstracts of their opinions given, and it is stated by the authors that "there is no authentic record of fatal copper poisoning, and many of the best authorities do not consider copper a

true poison; they hold that it is a natural constituent of the body, and in minute quantities has no effect upon man."

LEONARD P. KINNICUTT.

**Water Problems of Santa Barbara, California.** BY J. B. LIPPINCOTT. *U. S. Geol. Survey, Water Supply and Irrigation Paper No.* 116, 99 pp.; map, plates, figures.—This report contains a number of analyses of the water used by, or available to supply, the town of Santa Barbara, with critical discussions.

W. F. HILLEBRAND.

**Septic Tanks and Intermittent Sand Filters at Saratoga Springs, New York.** BY F. A. BARBOUR. *Jour. Assoc. of Eng. Societies*, **34**, 33-53 (1905).—The text of this article is based on a paper read by Mr. Barbour, one of the designers of the plant, before the Sanitary Section of the Boston Civil Engineering Society, January 4, 1905, and is a full description of the Saratoga plant, illustrated by plans and half-tones.

The amount of sewage at Saratoga ranges from about 1,500,000 gallons in winter to 2,500,000 gallons in summer, and the design of the plant was based on these figures. It consists of a pumping station, a septic tank, an aerator and covered dosing tank, and 20 approximately acre sand filtration beds. The covered septic tank, consisting of 4 units, has a total capacity of 1,000,000 gallons, each unit being 51½ by 9½ feet in plan, with a sewage depth of 7¾ feet at inlet and 8½ feet at outlet, and is built of concrete. The sewage is admitted to the tanks at a level of 3½ feet below the water line, through four openings in a pipe supported on a concrete bracket. The effluent passes from the tank through two horizontal rows of 2-inch pipe placed about 3½ feet below the sewage line. These pipes discharge into a narrow chamber extending the whole length of the tank, and provided with a weir over which the effluent flows to the respective outlet chambers. From the outlet chambers the effluent can be sent to the aerator or directly to the dosing tank. From the dosing tank it is discharged automatically, by the aid of a Miller siphon, upon the intermittent filtration beds. The dose is 35,000 gallons applied at the rate of 8 cubic feet per second, and is well distributed over a bed 1 acre in area, containing sand 0.2 mm. effective size. In extreme conditions of temperature a larger dose is applied, in order to keep the beds open. The plant has been in continual operation since July, 1903. The sewage is rather a dilute sewage, except during the months of July and August—the average free ammonia equaling 2.00, the albuminoid 0.40, the oxygen consumed 5, and the suspended solids 20 parts per 100,000. The sewage has thus far been passed through only three of the units of the septic tank, and the time of retention in the tank has varied from ten to fifteen hours—the shorter period being in the month of August, when, though the sewage is the strongest, the temperature is the highest, and the

bacterial activity the greatest. About 65 per cent. of suspended solids are removed by the septic treatment. From the beginning of the operation of the plant up to January 1, 1905, 1,000,000 pounds of dry solid matter has entered the tank. Of this amount 350,000 pounds had passed out, but so finely comminuated and decomposed as not to form a deposit on the sand filters. Of the 650,000 pounds of solids removed by the septic tank, 450,000 pounds had been liquefied or changed into gas, leaving only 200,000 pounds in the tank, 25,000 pounds of which was in the form of a deposit, and the balance as a floating scum. The specific gravity of this scum averages about 0.973, that of the deposit 1.025. The sewage is a strictly domestic sewage, probably the most favorable for septic treatment. The tanks have never been cleaned out, and no solid matter has been taken from them, and on January 1, 1905, there was 10 per cent. less solid matter in the tanks than on January 1, 1904, and Mr. Barbour says: "It would seem as if the operation might extend indefinitely without the withdrawing of any sludge."

The following figures show the character of the scum and the deposit as withdrawn by the Fowler gauge:

| | Scum. Per cent. | Deposit. Per cent. |
|---|---|---|
| Moisture | 86.5 | 94.0 |
| Volatile matter | 10.0 | 4.5 |
| Mineral residue | 3.5 | 1.5 |

The effect of the aerator on the effluent from the septic tank is shown by the following figures: The sewage entering the tank contains 4.3 per cent. dissolved oxygen; the effluent from the septic tank, 0, immediately after aeration 70.4, and as applied to the sand filters 40.4 per cent.; and by the way of comment, Mr. Barbour states: "These figures indicate the avidity of the liquid for oxygen, and while it may be difficult to demonstrate the actual value of this special aeration, it is reasonable to believe that otherwise the available oxygen in the beds would be used up preliminary to the commencement of nitrification. At all events, there has been no difficulty at Saratoga in effecting nitrification of the septic effluent."

The average amount of the aerated septic tank effluent used per bed *in use* has been about 140,000 United States gallons per day, applied in four doses; the entire area of the filter beds is kept in commission, the beds being used alternately, and the average rate per day for the whole field is about 60,000 gallons per acre. The purification of septic tank effluent "has varied from 99.3 per cent. in December, 1903, to 79 per cent. in March, 1904, on the basis of free ammonia in the raw sewage and the filtrate. The nitrates have ranged from 0.5 to 2.5 parts per 100,000."

LEONARD P. KINNICUTT.

**Interpretation of Sewage Analysis.** By EARLE B. PHELPS. *Technology Quarterly*, **28**, 40-60 (1905).—The important facts to determine regarding sewage are its concentration, its chemical characteristics and its condition, whether fresh or septic. First in importance is the concentration, that is, the amount of nitrogenous substances, of carbohydrates, of fats, of soap, and the amount of mineral constituents. The most important factor for determining the amount of nitrogenous substances present is the organic nitrogen as determined by Kjeldahl's process. The so-called "albuminoid ammonia" has no value, according to Mr. Phelps, as a factor in determining the total amount of nitrogenous substances present, and the free or saline ammonia is only of value when used in connection with the organic nitrogen factor in determining the condition of the sewage. In very fresh sewage, as the sewage of a large, intercepting sewer, the ratio of the ammoniacal nitrogen to the organic nitrogen will be close to unity, while a very old or septic sewage in warm weather may show a ratio as high as 7 to 1. Between these two extremes will be found ratios for ordinary sewages. The ratio between the organic nitrogen and the ammoniacal nitrogen though influenced by the age of the sewage is more dependent on temperature, and the number and character of the bacteria present, and represents consequently, the amount of change that has taken place in the sewage, rather than the age of the sewage, and gives the condition of sewage when the sample was taken. In determining this ratio, the author states: "The organic nitrogen value to be used is not the actual value found, but should be calculated on the assumption that the total nitrogen, organic plus ammoniacal, has not undergone any diminution during treatment." The oxygen-consumed test has no value as a concentration factor, standing in the same relation to a total carbon as the albuminoid ammonia does to a total nitrogen, and the relationship is still more unsatisfactory, as it represents only 2 to 3 per cent. of the carbon present, while the albuminoid ammonia represents over 33 per cent. of the total organic nitrogen. Very little can, therefore, be known about the carbonaceous matter in sewage until accurate determinations of total carbon are included in the regular routine of sewage analysis. The amount of fat and soap in sewage is not difficult to determine and the determination should be made more often than is now the case, as these substances are responsible for much of the clogging of sand filters in the purification of sewage. According to Clark (*Jour. Assoc. Eng. Soc.*, **33**, 156), the average amount of fat and soap in Lawrence sewage is 6 parts in 100,000, or 20 per cent. of the volatile substances. The amount of chlorine, the amount of total and of fixed solids are the other valuable factors in determining the concentration of the sewage, and give a good idea as to the amount of mineral matter present. The condition of the sewage is not only shown by the ratio that exists between the

nitrogen of the ammoniacal ammonia, and the total organic nitrogen, but also by the oxygen, either dissolved or in the form of nitrites or nitrates. Dissolved oxygen, nitrites and nitrates, enter the sewage with the water used in the city, and the amount of oxygen found in any of these states depends upon the action of bacteria or their products. These determinations are, therefore, a measure of bacterial activity. Chlorine, besides being a concentration factor, is shown by the author to be, in certain cases, a comparison factor, and he believes that in domestic sewage the ratio between the organic nitrogen and the chlorine is as 1 to 1 or 1 to 1.5. LEONARD P. KINNICUTT.

**The Bacteriolysis of Peptones and Nitrates.** BY STEPHEN DEM. GAGE. *Technology Quarterly* 18, 6-39 (1905).—This paper was read before the American Chemical Society at the Philadelphia meeting, December 29, 1904, and was published substantially in this Journal **28**, 327-363. LEONARD P. KINNICUTT.

**Indoor Humidity.** BY HENRY M. SMITH. *Am. Gas Light Journal*, **82**, 330, 451, 490 (1905).—From the relative humidity and the temperature of an atmosphere, the amount of moisture present in the air, the amount that would be present if the air was saturated with moisture, and consequently the saturation deficit can be determined. The author gives as the relative humidity of the air of New York City for the months of October to April inclusive 73, and the temperature as 44; for indoor conditions during the same months, the relative humidity as 30, and the temperature as 72, and for the atmosphere of a high, dry city, as Denver, Colorado, relative humidity as 50, and the temperature as 51. This shows that each cubic foot of the air of New York City has a saturation deficit of 0.890 grain per cubic foot; that of Denver of 2.111 grains, and that the air of living rooms has a deficit of 5.956 grains per cubic foot, and expresses graphically the excessive dryness produced by artificial heating without artificial moistening. This excessive dryness of the air of living rooms, according to the author, besides being unhealthy, necessitates the heating of the air to a much higher temperature than would otherwise be necessary for bodily comfort, and consequently a large waste of fuel. According to experiments made during the winter of 1902-3, he found that with a relative humidity never below 50 per cent. or above 70, a temperature of 72° was uncomfortably hot, 68° warm, and 65° comfortable, and as a result determined by repeated experiments, that a temperature of 65° to 68°, with a relative humidity of 67 per cent., produced the most comfortable conditions, which were in marked contrast to a temperature of 72°, with a relative humidity of 30 per cent. (Apparatus for producing high relative humidity is not described.) Theoretically, the above facts can also be shown as follows: The

reading of a wet bulb thermometer is a fair measure of the temperature that is felt by the moist surface of the body, the temperature produced by evaporation, and this temperature is called, by Prof. Harrington, of the United States Weather Bureau, the "sensible temperature." Given a room at the temperature of 72 with a relative humidity of 30, another room at a temperature of 65 with a relative humidity of 60, the "sensible temperature" in the first case, will be 55, and in the second case 57; or in other words, a person will feel warmer in a room at the temperature of 65 with a relative humidity of 60, than in a room at the temperature of 72 with a relative humidity of 30. Depending upon a thermometer, as a sole guide in the heating of buildings is not only inadequate, but misleading. A hygrometer should also be used, and artificial moistening of the air should be employed. The reason that most of the moistening apparatus in use has been, in the main, unsatisfactory is because their control has not been independent of the control of the heat source. LEONARD P. KINNICUTT.

**The Regulation of the Milk Supply of Great Cities.** BY W. H. PARK, *Amer. Jour. of Public Hygiene*, **15**, 286-290 (1905).—Typhoid fever, scarlet fever, diphtheria and tuberculosis can be transmitted through milk. Bacteria derived from diseased cattle, such as those suffering from inflamed milk ducts, enteritis or sepsis, may cause illness in those drinking the milk. The ordinary bacteria of milk, derived from cow manure, hay dust, and other sources, are distinctly dangerous when in large numbers, especially to infants, because of the chemical changes, which they produce in the milk. Bovine tuberculosis can be transmitted to children, and health authorities should, as soon as practicable, insist on milk from cattle free from tuberculosis. Milk containing pus cells and streptococci, showing diseased cattle, should be condemned. Milk containing over 500,000 bacteria to a cubic centimeter shows uncleanliness in the dairy, or that the milk was shipped warm, or that it must be old milk; and though it is true such milk would not harm an adult, or, when sterilized, seriously injure the average infant, yet it is decidedly worse than it should be, and shows such carelessness in the milkman or agent, that it is probable it would not be safely guarded from the germs of contagious diseases. Another matter that requires regulation is the temperature at which the milk is kept. The cleanest milk when kept at a high temperature, soon sours. A temperature of 50° F., keeps the milk bacteria from increasing rapidly, and is a temperature that can be easily maintained by farmer, railroad and dealer.

LEONARD P. KINNICUTT.

## INDUSTRIAL CHEMISTRY.

**A Simple Method of Calculating Water Analyses and Amounts of Substances to be Added for Preventing Scale and Corrosion in Boilers.** BY SAMUEL S. SADTLER. *J. Frank. Inst.*, March, 1905, p. 217.—Both tables and straight line curves are given, representing ratios of the various elements found in natural waters to chlorine, so that from the weights of precipitates found the amounts of acid and basic oxides can be calculated and equivalent quantities paired off, thus giving the amounts of the constituents as they are thought to exist in the waters. The amount of correctives for preventing scale, etc., may be also obtained from the curves by simple inspection. S. P. SADTLER.

**The Production and Modern Uses of Carbonic Acid.** BY JOHN C. MINOR, JR. *Chem. Engineer*, February, 1905.—There are about 37 factories in the United States liquefying carbonic acid, and the annual output amounts to about 30,000,000 pounds. The product obtained varies from 98 to 99.5 per cent. carbon dioxide. In the calcination process magnesium carbonate (Grecian magnesite being generally used, containing about 95 per cent. of magnesium carbonate) is finely ground and roasted in iron retorts. The gas begins to come over at a very low heat and is allowed to escape into the atmosphere until all air, which has been in the retorts, has been displaced The carbonate is roasted until after about twenty-four hours only 2 per cent. of the original carbonate remains; the residue is then used for fire-resistant furnace-linings.

In some places the carbon dioxide is produced by action of sulphuric acid on a carbonate, generally calcium carbonate. In this case the calcium sulphate is used in the paper trade as a filler, known as crown filler, satin white, etc. Where magnesium carbonate is used with acid, Epsom salts are produced and are crystallized out, dried and sold.

The third source of the supply of carbon dioxide are the vats in breweries, from which, when enclosed, carbon dioxide can be drawn off. The difficulty with the use in this case, however, is the odor of the beer which is very hard to remove.

The fourth process, and one used to a considerable extent abroad, is by the burning of coke. The carbon dioxide is absorbed in potash-lye, from which it is afterward expelled, the regenerated potash solution being then used for a fresh absorption.

To prevent a loss of potash solution, by means of sulphurous acid that will come off from the sulphur contained in the coke, the gases are first washed with hot and then with cold water.

The fifth method noted is the obtaining of carbon dioxide from the natural carbonated waters at Saratoga Springs, N. Y. In this way about 20,000 pounds of carbon dioxide are produced per day.

After being caught in the gasometer, from whichever method produced, the gases are passed through calcium chloride driers and then to the compressor, which generally works in three stages, at 60, 300 and 1,000 pounds. After each stage the gas is thoroughly cooled.

Great difficulty was found in obtaining cylinders that were of minimum weight and yet strong enough to withstand pressure. Those now used withstand an internal pressure of 3,700 pounds per square inch and are either of lap-welded or of seamless steel, the smaller size diameter being 5 $^{9}/_{16}$ inches outside and 48 inches long, with a water capacity of 30 pounds, into which 20 pounds of gas are filled, and the larger size of 8$^{9}/_{16}$ inches outside diameter and 51 inches long, with a water capacity of 90 pounds and filled ordinarily with 60 pounds of gas. This gives a ratio of gas to water capacity of about 67 per cent. and the pressures reached under ordinary conditions are as follows:

At 60° F. 745 pounds per square inch; at 80° F. 966 pounds per square inch; at 110° F. 1,715 pounds per square inch; at 130° F. 2,240 pounds per square inch.

The bursting pressure for the seamless tubes varies between 5,100 and 5,900 pounds, and for the lap-welded between 4,900 and 5,500 pounds, and every tube before using is tested to 3,700 pounds per square inch.

Attention is called, among various uses of liquefied carbon dioxide, to the fact that an ordinary cotton steamship could carry in 150 cylinders enough gas to extinguish fire in every one of her holds.

The use of the gas is also mentioned for sterilizing and preserving food which promises results with the use of the gas at high pressures.
S. P. SADTLER.

**Notes on Cement Testing.** BY WILLIAM PURVES TAYLOR. *Chem. Engineer*, February, 1905.—The main points in the use of cement in construction work are that it should have strength and soundness. Any tests to show these points are of the greatest importance, while other tests, such as fineness, specific gravity, time of setting, and chemical composition are secondary. It is a fact, however, that these latter tests are those generally applied and the more important tests are the least exact, as the personal equation enters so much into the matter of mixing, moulding, handling and breaking that concordant results are not generally obtainable, while tests, such as specific gravity, are of no importance. When abnormal results are obtained the cause should be searched for and the cement should not be condemned outright for a quality that may be actually beneficial in itself.

The absorption of moisture during the process of seasoning will cause a considerable lowering of specific gravity. In a cement with a specific gravity of 3.12 originally, with a figure of 3.17 for drying

at 112°, on keeping for six months it gave 3.09 undried, and 3.16 when dried. After one year it gave 3.06 undried and 3.14 dried, and after two years 3.00 undried and 3.09 dried. At all periods the values from the ignited cement were practically the same.

The strength tests on these cements were satisfactory up to one year, after which time they ran rather low, the best test being at six months, although at this point the specific gravity was below specifications.

When a low specific gravity is obtained, it is necessary to dry and ignite to determine how much is due to ageing and seasoning of the material; if the strength tests are then satisfactory the cement should not be rejected.

In examining cements for adulterants the author suggests the use of a heavy liquid such as methylene iodide which has a specific gravity of 3.25, which is a little higher than the heaviest cements. The lowest specific gravity of Portland cement is about 3.05, and since the heaviest of the adulterants is rarely over 2.85 it follows that if the liquid can be brought to a specific gravity of 2.95 a ready separation can be obtained.

The point 2.95 could be obtained by the use of a small crystal of aragonite, which has that gravity. If benzene is added to methylene iodide until the aragonite neither sinks nor floats, the liquid has the desired density. If a small weighed quantity of the sample is placed in a closed separatory funnel and is stirred and allowed to stand for an hour or more, a ready separation of the Portland cement is effected, and the natural cement or adulterant will float upon the top. S. P. SADTLER.

**Commercial Possibilities of Blast-Furnace Gas for the Development of Electric Power.** BY F. DUP. THOMPSON. *Electrochem. and Metal. Ind.*, March, 1905.—Some of the conditions necessary for the development of power from waste furnace-gases are that a profitable market must be within reach and that an uninterrupted supply of gas must be available. For this latter purpose no less than three blast-furnaces must be available as a source of supply, although with groups of more than three, greater security against interruption would result. With three furnaces one would be out of blast at some time for relining, and another might be stopped for some special reason.

The great difficulty in this work is that the furnaces must be kept in blast even when other conditions are adverse and the profit must at least pay for the labor and material invested in manufacture of apparatus in which there is no market for the production and at least part of the loss due to a falling market.

The labor element is a serious one due to the mining and transportation of fuel. It is frequently necessary, in order to avoid inability to supply gas from the furnace, to have a gas producer plant. This would, however, be but a partial remedy and would

involve an additional yearly charge for power of not less than $7.50 per horse-power.

The waste gases of the blast-furnace contain about one-half of the total heat originally possessed by the fuel and their value is approximately in direct proportion to the coke consumption per ton of iron.

A conservative estimate of the percentage of the waste gases necessary to heat the blast would be 30 per cent.

A table, showing the comparison of steam and gas engines for auxiliary power purposes, is interesting in showing the surplus available under the different circumstances.

| Use. | Steam engines. Per cent. | Gas engines. Per cent. |
|---|---|---|
| Heating the blast | 18–33 | 18.0–33 |
| Compressing the blast | 33–40 | 16.5–20 |
| Auxiliaries | 7–10 | 3.5– 5 |
| Surplus available | 42–17 | 52.0–42 |
| | 100–100 | 100.0–100 |

With the surplus taken at 52 per cent. we have available 4,680,000 B. T. U. per ton of iron. From this heat it is possible to develop 468 horse-power per ton of iron made per hour with gas engines, which have a thermal efficiency per effective horse-power of 25 per cent. or can produce one effective horse-power per 10,000 B. T. U. per hour. Manufacturers of gas engines are willing to guarantee this result when their engines are operated at full load. For blast-furnace making 300 tons of iron per day we may rely with certainty upon obtaining not less than 300 tons × 468 horse-power = 5850 horse-power in twenty-four hours, or, let us say, 6000 horse-power.

The matter of gas-cleaning is one of great importance, although some authorities state that it is unnecessary, but it should be carried out if for no other reason than that the cleaning process at the same time reduces its temperature and thus increases its density, thereby increasing the power available from a cylinder of given dimensions. The combined purifying and cooling is effected with water by allowing a stream of water to enter at the center of a fan, which drives the water in a fine spray with the gas and collects the dust.

To lessen the cost of power the gas is pre-cooled in towers. In giving the cost of power plants units of 200 to 300 horse-power are figured upon.

In the following tabular statement gas engines in both classes are 2000 horse-power each, seventy-five revolutions per minute, one unit in each case in reserve.

| Items. | Class "A." 4 1000-kw. Units 50 per cent. Overload capacity. | Class "B." 4 1500-kw. Units No. Overload capacity. |
|---|---|---|
| Land | $ 5,000 | $ 5,000 |
| Building | 67,500 | 67,500 |
| Engine foundations | 6,000 | 6,000 |
| Crane, traveling | 8,000 | 8,000 |
| Piping | 16,000 | 16,000 |
| Compressors and engines | 8,000 | 8,000 |
| Pumps and engines | 12,000 | 12,000 |
| Exciters and engines | 15,000 | 15,000 |
| Switchboard, wiring, lamps | 16,000 | 16,000 |
| Generators | 100,000 | 120,000 |
| Gas engines | 280,000 | 280,000 |
| Exhaust stack | 4,000 | 4,000 |
| Gas-washing plant | 30,000 | 30,000 |
| Gas-holder and piping | 10,000 | 10,000 |
| Office and fixtures | 2,500 | 2,500 |
| | $580,000 | $600,000 |
| Cost per kilowatt of total station capacity | 145 00 | 100 00 |
| Cost per kilowatt of station capacity operated | 193 00 | 133 33 |

The author sums up by saying wherever there is a large demand for power, cheap water-power is not available and blast-furnaces are, the gas engine-power plant need fear no rival.

S. P. SADTLER.

**The Recovery of Tin Scrap.** BY JAMES MILLER NEIL. *J. Soc. Chem. Ind.*, February 15, 1905.—Tin scrap is collected and shipped in pressed bundles of about 250 pounds each and brings $13.50 per long ton in New York. The amount of actual tin present rarely reaches 2 per cent. on the average. The recovered tin has a value of about 25 cents a pound, while the stripped iron brings about $14 a ton at the iron works. Traces of tin render this iron brittle.

Processes that are practically successful are the caustic soda electrolytic process, the stannic chloride process and the Browne-Neil process.

A purely electrolytic process, that of P. Nauhardt, of Germany, Eng. patent 21,942, has a rotating drum which carries the scrap, which is troublesome to fill and expensive.

The stannic chloride process, invented by P. Bergsor, of Copenhagen, Eng. patent 7,026, 1900, has the disadvantage that the chlorine, in addition to attacking tin, attacks the iron to a certain extent; also oxides of tin are formed.

The use of caustic soda as an electrolyte gives useful results, but it is impossible to remove all tin, there being about 0.2 per cent. remaining on the scrap.

With the Browne-Neil process ferric chloride acts upon tin, absolutely freeing the iron of that metal at a boiling heat. The ferrous stannous chloride solution which then results is run into a series of electrolytic baths of which the outer ones are composed of concrete and the inner ones of porous clay.

In the outer ones a small stream of the ferrous stannous chloride solution is kept running continuously, and into the porous cells is run a solution of ferrous chloride, derived from the last of the series of the concrete baths. The cathode consists of sheets of pure tin and the anode of graphitized carbon. The whole series of baths are then connected to the electric current. In its flow the ferrous stannous chloride solutions deposit on the cathode large bright crystals of pure metallic tin, while the chlorine liberated at the anode immediately converts the ferrous chloride solution flowing through the porous-baths into ferric chloride, which is pumped back to the dipping tank to be again reduced by fresh scrap tin, so that in the first of the series of plating-baths a continuous stream of ferrous stannous chloride solution passes through the outer chamber, which deposits its tin and becomes gradually richer in ferrous chloride until, as it leaves the last of the series, it contains no tin at all. It is this solution of ferrous chloride which is run through the porous-baths and by absorbing the chlorine becomes converted into ferric chloride.

There is obtained 34 pounds of pure metallic tin every twenty-four hours, at an electrical expense of 2 to 3 horse-power per hour. The strength of the electric current carried on each series of baths is 25 volts at 500 amperes and the sizes of baths are so calculated as to carry on each ½ square inch a current of 200 amperes.

The amount of tin recovered per ton of scrap treated is 40 pounds.

S. P. SADTLER.

**Standard Methods of Sampling. A Review with Some Suggestions.** BY MARTIN L. GRIFFIN. *J. Soc. Chem. Ind.*, February 28, 1905.—The author believes that too much effort has been made to improve methods of uniform analysis rather than to provide uniform methods of sampling. The Association of Official Agricultural Chemists of the United States has outlined methods for sampling soils, fertilizers, etc., that are fairly complete, but the author believes this work should be carried through for other products.

The chemist is apt to wash his hands of all responsibility in sampling and leave the matter to unskilled labor.

A great many historical references as to efforts to outline this subject are given which show that this subject has been taken up, but not carried along systematically.

S. P. SADTLER.

**The Manufacture of Hydraulic Cements.** BY A. V. BLEININGER. *Geol. Survey of Ohio, Bull. No. 3,* Fourth Series, 391 pp.;

figures.—This book is written with special reference to the cement manufacturer and cement chemist. It contains the following chapters: General considerations on the hydraulic cements; raw materials of the cement industry; analysis and testing of the raw materials; manufacture of pozzuolane and natural cements; on the nature of Portland cement; the compounding of Portland cement mixtures; winning and preparation of the raw materials; the burning of Portland cement; the grinding of the clinker and general arrangement of plants; the properties of Portland cement and the testing of cement.

W. F. HILLEBRAND.

## AGRICULTURAL CHEMISTRY.

**Director's Report, 1904.** BY W. H. JORDAN. N. Y. Agr. Expt. Sta.—Besides giving a short sketch of the work done in other departments, this report presents a summary of the investigations carried on by the Department of Chemistry, in which attention is called to the fact that what in Bulletin 215 was called casein monolactate is, in reality, according to later experiments, nothing more than free casein. Other subjects mentioned are the "Composition of commerical whale oil soaps" (see abstracts in this review), "The science and practice of making cider vinegar" (see abstract in this review) and a "Study of the principal phosphorus compound of wheat bran," in which is stated that this compound is anhydro-oxymethylene diphosphoric acid, $C_2H_8P_2O_9$, which plays a peculiar rôle in nutrition.

J. A. LECLERC.

**Nutritive Value of Prepared Cereal Products.** BY R. D. MILNER. *Report Storrs Agr. Expt. Sta., 1904*, p. 210.—This article contains a short sketch of the development of the "Breakfast food." Samples of foods made from wheat predominate, but there are also a goodly number made from oats, corn, rice, barley and malt preparations. Tables showing the per cent. of the regular food constituents and energy per gram of all these breakfast foods are given.

Results show that the same brand from the same factory may differ more in composition than similar products from different factories. The protein content and energy per gram of meat is compared with that of the various classes of cereals, showing that some of the cereals have about two and a half times as much energy per gram as does lean beef. A chapter on "Predigested" cereals shows that "the so-called predigested of malted products were no more thoroughly digested than those of the preparations not malted," only a third or less of the starch being found converted into soluble material in most of the samples. A list of the breakfast foods, their cost per package, weight per package, price per pound and the amount of protein and energy to be had for 10 cents is also given.

J. A. LECLERC.

**Spray Solutions for San Josè Scale.** By Thos. B. Symons. *Md. Agr. Expt. Sta., Bull. 99*, 12 pp.—The bulletin gives the results of the tests of different spraying materials for the control of San Josè scale, and of various methods of making the lime, sulphur and salt wash. L. S. Munson.

**The New K-L Mixtures and San Josè Scale.** By C. P. Close. *Del. Agr. Expt. Sta., Bull. 68*, 23 pp.—The bulletin gives results obtained with the new K-L spraying mixture consisting of kerosene, hydrated lime and water. Very favorable results are obtained by the use of this mixture where properly made and applied. L. S. Munson.

**Sulphur Washes for Orchard Treatment.** By P. J. Parrott, S. A. Beach and F. A. Sirrine. *N. Y. Agr. Expt. Sta., Bull. 262*, 28 pp.—The bulletin gives the results of continued experiments to determine to what extent sulphur washes may be used in the place of bordeaux-arsenical mixtures for orchard treatment. One application of sulphur wash to apple trees reduced the scab 22 per cent., and a combined treatment consisting of one application of sulphur wash before blossoming and two applications of bordeaux-arsenical mixture after blossoming reduced the scab 73.7 per cent. and codling moth injury 27.1 per cent., which are practically identical with results obtained by three applications of bordeaux-arsenical mixture. L. S. Munson.

**Preliminary Experiments with Vapor Treatments for the Prevention of the Stinking Smut of Wheat.** By W. A. Wheeler. *S. Dak. Agr. Expt. Sta., Bull. 89*, 19 pp.—Owing to disadvantages of the wet treatment for smut formaldehyde vapor was tried. This treatment proved effective in destroying the stinking smut of wheat. L. S. Munson.

**The Composition of Commercial Soaps in Relation to Spraying.** By L. L. Van Slyke and F. A. Urner. *N. Y. Agr. Expt. Sta., Bull. 257*, 10 pp.—Results of analysis are given of nine samples of commercial whale oil soap. These nine samples varied in content of water from 11 to 55 per cent., soap from 15 to 60 per cent., and free alkali from none to 1.30 per cent., and the authors attribute the erratic behavior of these soaps when used as sprays to this wide variation in composition. Home manufacture of these soaps is recommended in order to secure uniformity of composition. Influence of excess of free alkali was studied and it was found that an excess of 5 per cent. of free alkali caused but little injury to foliage and trees. L. S. Munson.

**Rapid Method of Removing Smut from Seed Oats.** By J. C. Arthur. *Ind. Agr. Expt. Sta., Bull. 103*, 8 pp.—A solution of formalin containing one pound of formalin to 25 gallons or more of water is a very efficient spray for treating oats for smut. Oats

thus treated show a slightly lower germination and much lower percentage of smut. Sulphur dioxide was also used, but was found to be inferior to formalin. L. S. MUNSON.

**A Chemical Study of the Tea Industry in South Carolina, Part I.** BY F. S. SHIVER. *S. Carolina Agr. Expt. Sta., Bull.* 96, 32 pp.—The author discusses (1) historical review, (2) production and consumption, (3) botanical characteristics, (4) the soil and climate, and (5) the cultivation of tea. Under the subject of soil and climate the soil requirements of the plant and the effect upon the quality and flavor of the tea are discussed. Analyses of a number of tea soils at Pinehurst, S. C., are given, and these seem to meet all the essential requirements laid down by the authorities on tea culture. L. S. MUNSON.

**Mixtures and Appliances for Spraying.** BY T. C. JOHNSON. *W. Va. Agr. Expt. Sta., Bull. 93,* 49 pp.—The bulletin gives the methods of preparation of a large number of spraying mixtures for use as fungicides and insecticides, and the descriptions and cuts of appliances used in the application of these sprays.
L. S. MUNSON.

**A Study of the Chemistry of Home-made Cider Vinegar.** BY L. L. VAN SLKYE. *N. Y. Agr. Expt. Sta., Bull. 258.*—This investigation, for which most of the chemical work was done by J. A. LeClerc, covered the composition of juices from different varieties of apples, changes in composition during alcoholic and acetic fermentations, conditions affecting these changes and the destructive fermentation of vinegar on long standing. In practice 100 parts of sugar yield 45 to 47 parts of alcohol, 100 parts of which in turn yield about 120 parts of acetic acid. With cellar temperature most of the sugar is changed to alcohol in from five to six months, most rapidly at about 85° F. Acetic acid fermentation takes place slowly, and is most satisfactory between 65° and 75° F., and requires about eighteen months. Vinegar containing "mother" hastens the fermentation. Loss of acetic acid, due to the action of organisms, is prevented by the exclusion of air. Malic acid decreases during the making process and while all vinegars gave a precipitate with lead acetate some contained no malic acid. Solids decrease rapidly during the first three months, but may increase later. Where good fruit is used and fermentation is properly conducted, there should be no difficulty in making cider vinegar containing 4.5 per cent. acetic acid in eighteen to twenty-four months. Vinegars low in acetic acid are caused by poor fruit, unfavorable conditions of fermentation and lack of care of the finished vinegar. F. P. VEITCH.

**Fertilizer Control Reports.** BY GEORGE ROBERTS. *Report Division Fertilizer Control, 22d Report Cal. Agr. Expt. Sta.*—

Brief report of the work of the division for the year ending June 30, 1904. F. P. VEITCH.

**Fertilizers Registered for Sale in Arkansas during 1905.** BY A. M. MUCKENFUSS. *Ark. Agr. Expt. Sta., Bull. 86.*—Analyses of a number of brands are given. F. P. VEITCH.

**Commercial Fertilizers.** BY J. H. STEWART AND B. H. HITE.—Complete report for 1904, *W. Va. University Agr. Expt. Sta., Bull. 95.* F. P. VEITCH.

**Fertilizer Inspection.** *Me. Agr. Expt. Sta., Bull. 114.*—Contains analyses of manufacturers' samples of fertilizers licensed before March, 1905. F. P. VEITCH.

**Analysis of Commercial Fertilizers.** *S. C. Agr. Expt. Sta., Bulls. 102, 104, 106, 107.* F. P. VEITCH.

**Experiments with Potatoes on Home-Mixed Fertilizers.** *Me. Agr. Expt. Sta., Bull. 112.*—Where the crops matured before frost the yields with home-mixed fertilizers were as good as with standard fertilizers, but apparently owing to the slow availability of the nitrogen of the home-mixed goods and to the relative deficiency in phosphoric acid, frosts were more fatal to crops grown with home-mixed goods and the yields consequently lower.

F. P. VEITCH.

**Report of the Division of Soils.** *22nd Report of the Cal. Agr. Expt. Sta.*—This article reports a number of soils examined for farmers, enumerates the mistakes usually made in taking samples and gives directions for taking samples by the farmer. The work of this division also embraced the collection of typical soils for the Louisiana Purchase Exposition, an examination of the soils of the Salton and Imperial regions, examination of minerals, preparation of an agricultural map of the state and mechanical and physical examination of soils.

F. P. VEITCH.

**Asparagus and Salt.** BY ERNEST WALKER. *Ark. Agr. Expt. Sta., Bull. 86.*—The old practice of using large quantities of common salt in growing asparagus is referred to and a single year's experiment showing a gain of 13.5 per cent. in yield from three applications, total of about 10,000 pounds of salt per acre is reported. F. P. VEITCH.

**Waste Waters from Pulp and Paper Mills.** BY M. L. GRIFFIN. V. Internationaler Kongress für angew. Chemie, Bericht, II, s. 713. Brief general discussion containing nothing new.

F. P. VEITCH.

**Analyses of Cuban and Argentine Barks, Woods, Etc.** BY L. E. LEVI AND J. F. SIGEL. *Hide and Leather.* Analyses of

specimens of material secured from the Cuban and Argentine exhibits at the Louisiana Purchase Exposition are given as follows:

CUBAN EXHIBIT.

| | Soluble solids. Per cent. | Non-tannin. Per cent. | Tannin. Per cent. |
|---|---|---|---|
| Corteza de Jaqua | 25.40 | 20.96 | 4.44 |
| " " Carba | 13.58 | 5.37 | 8.21 |
| " " Peralijo | 9.36 | 3.02 | 6.34 |
| " " Mangle Colorado | 30.21 | 6.13 | 24.08 |
| " " Juearo | 11.75 | 4.59 | 7.16 |
| " del Arbol Jucan | 12.29 | 3.16 | 9.13 |
| " de Gamaqua | 8.17 | 1.92 | 6.25 |
| Hojas de Mangle Colorado | 14.23 | 9.04 | 5.19 |
| " " Peralijo | 30.10 | 19.38 | 10.72 |
| " " Poloban | 37.10 | 19.43 | 19.67 |
| Maranon | 9.07 | 3.06 | 6.01 |
| Sabien | 5.28 | 3.61 | 1.67 |

ARGENTINE EXHIBIT.

| | | Soluble solids. Per cent. | Non-tannin. Per cent. | Tannin. Per cent. |
|---|---|---|---|---|
| Molle (Lithraea Gilliesii Gr.) | Bark | 24.93 | 8.14 | 16.79 |
| | Wood | 9.63 | 5.97 | 3.66 |
| Churqui (Mimosa Farinosa Gr.) | Wood | 6.53 | 2.67 | 3.86 |
| Iviraro-Vivau (Ruprechti excelsa Gr.) | Bark | 5.41 | 3.81 | 1.60 |
| | Wood | 3.88 | 2.50 | 1.38 |
| Guayacan Itin (Caesalpinia melanocarpa Gr.) | Wood | 9.08 | 0.99 | 8.09 |
| | Fruit | 34.68 | 19.90 | 14.78 |
| Palo de rivera de Formosa | Bark | 10.32 | 2.94 | 7.38 |
| | Wood | 4.58 | 2.05 | 2.53 |
| Curupay-Cebil Colorado (Piptadenia cebil Gr.) | Bark | 25.92 | 10.92 | 15.00 |
| Guayaibi Blanco | Bark | 18.75 | 11.69 | 7.06 |
| | Wood | 4.65 | 2.74 | 1.91 |
| Sacha Naraanja | Bark | 15.44 | 12.23 | 3.21 |
| | Wood | 3.86 | 2.90 | 0.96 |
| Tusca (acecia cavenia, H. A.) | Bark | 13.54 | 3.46 | 10.08 |
| | Wood | 5.34 | 2.65 | 2.69 |
| Piquillin (condalia lineata A. G.) | Bark | 12.00 | 2.99 | 9.01 |
| | Wood | 9.33 | 3.10 | 6.23 |
| Lapacho negro (Tabeuia Avellanedae Ltz.) | Bark | 9.47 | 6.25 | 3.22 |
| | Wood | 4.71 | 3.25 | 1.46 |

F. P. VEITCH.

## PATENTS.

[A copy of any patent will be sent to any one who sends five cents, with the number, name of the patentee, and subject of the invention to the Patent Office.]

SEPTEMBER 27, 1904.

771,024. Jaques Oettli, Lausanne, Switzerland. Assignor to Société pour l'exploitation des Inventions, Berne, Switzerland. **White lead.** A lead electrode is dissolved in a bath of 1 per cent. of common salt by a current of 1 ampere per square decimeter, at a temperature of 15° C.

771,025. As above for **zinc white.** Zinc electrodes are dissolved by a current of 10 amperes per decimeter square in a 1 per cent. bath of sodium sulphate at a temperature of 60° C.

771,062. Carl Growen, Bonn, Germany. **Artificial stone.** Magnesium oxychloride is made from hydrochloric acid and magnesite, ammonia and more magnesite are added till the acid is neutralized, and the mixture poured into molds.

771,075. Cosmo Kendall, Upper Norwood, England. **Grading minerals by oil.** Graphite ore is mixed with water, kerosene or similar hydrocarbon added, and the mixture projected horizontally through a tank filled with similar material, whereby the graphite rises to the surface, and is drawn off.

771,080. Richard Liebold, Weimar, Germany. **Acid-proof cement.** To 100 kilos of cement burnt, but before grinding are added a mixture of 300 grams of Japan wax, and 20 grams caustic lime dissolved in 8 liters of boiling water.

771,183-4. Paul Steenbock, Deutsche Wilmersdorf, Germany. **Vitreous cement.** An aqueous solution of beryllium nitrate is precipitated by silicic acid in soda-lye, and the precipitate is mixed with a finely ground mixture of lime, aluminum and silicon anhydride. The second has a mixture of aluminum and zinc phosphates as the last component.

OCTOBER 4, 1904.

771,241. Wm. A. Hall, Bellows Falls, Vt. **Paint.** Talc 400, tung oil 50, ammonia 1, casein 20, formaldehyde 2, and water 170 parts. Boracic acid, creosote and potassium oxalate may be added in small quantities.

771,257. Wm. M. Mackintosh, Liverpool, England. **Waterproofing fabrics.** Paraffin wax 60, almadena (Euphorbia) gum 20, carnauba wax and resin oil 10, asbestine and pitch 30 parts each. Asbestine is powdered asbestos.

771,277. Alice H. Schwarz, New York, N. Y. Assignor to Schwarz Ore Treating Co., Arizona. **Concentrating ores.** Hot, fatty matter solid at ordinary temperature, is mixed with the pulverized ore to which it adheres, the silica not attaching to it, and solidified by introducing cold water, the gangue and the ore are separated, and the fatty matter (paraffin) removed from the ore. Jacketed vessels with stirrers are used to mix the materials, and adjust the temperatures.

771,340. Thomas C. Van Housen and Wm. A. Meyers, Chicago, Ill. **Etching.** The article is covered with an etching ground and connected with a source of electricity as part of a galvanic couple, and in an electrolyte of dilute nitric acid which is continually churned against the face of the plate to be etched by a screw stirrer.

771,355. John L. Daniels, Jr., New York, N. Y. Assignor to

American Cigar Co., same place. Treating **tobacco.** The nicotine is oxidized by immersing the leaves in ammonium permanganate.

771,479. John W. Lewis, Bokoshe, Ind. **Artificial stone.** Sand 43, Portland cement 35, salt, Spanish whiting, gum acacia and boiled linseed oil 2 each, alum 3, rice water 4, Plaster of Paris 5 and Prussian blue ½ of a pound—all in pounds.

771,559. Charles E. Manby, Carnegie, Pa. **Steel alloy.** Iron 78.10, nickel 20.0, manganese 1.28, and ferrovanadium 0.62 parts.

771,629. Oscar Guttmann, London, England. Apparatus for **condensing nitric acid.** A length of condensing pipe has inlet and outlet socket unions thereon, and a small depending outlet for condensed acid with liquor seal. Several units may be joined.

771,645. Franz von Kugelgen and George O. Seward, Holcombe Rock, Va. Assignors to Willson Aluminum Co., New York, N. Y. **Decarburizing metal.** The molten metal is brought in contact with calcium, making a fusible slag that floats off.

771,646. Franz von Kugelgen and Heinrich Daneel, Breslau, Germany. Obtaining **metals.** An alkali haloid and metallic oxide are electrolyzed together, thereby getting a metal, an alkaline oxide and the halogen, the metallic oxide and alkaline haloid being continuously supplied.

771,669. Adolph Schnegass, Waltershausen, Germany. Forming **wooden articles.** The surface of the wood is filled with a paste of pumice and chalk 2 each, resin 1 and sulphuric acid to liquefy, then polished and saturated with glue, again polished, and the article cut out, all at ordinary temperature, or in the cold.

771,706. Clarence E. Broughton, Savannah, Ga. **Distilling wood.** The wood is treated with superheated steam under pressure till most of the turpentine is extracted, volatilized, and condensed; the temperature is then raised higher with direct flame on the wood to recover the rest of the turpentine.

771,760. David M. Balch, Coronado, Cal. Treating **seaweed.** The seaweed is dried and parched without charring, pulverized, and lixiviated, then drained, and the residue compressed in blocks for fuel, and the salts recovered.

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771,859. Franklin S. Clark and Edwin A. Harris. Assignors to Georgia Pine Turpentine Co., all of New York, N. Y. **Turpentine.** The wood is distilled, and the vapors condensed in successive coils, the lighter vapors being passed through lime.

771,984. Crawford H. Humphrey, Crawford Falls, Maine. Assignor to Lyman J. Haines, Mexico, Maine, and Seth E. Beedy,

Farmington, Maine. **Wood filler.** Pulverized clay, drying oil, and turpentine each 32, oxalic acid 3, and a drier 1 part.

771,999. Charles A. Potter, San Francisco, Cal. **Waterproofing feathers.** The barbs are curled, and then sprayed with a waterproofing solution as paraffin 20, spermaceti 8, stearin 4, gum dammar and paraffin oil 2 each, benzine and gasoline 150 parts each.

772,018. Elizabeth N. Alexandrian, Fresno, Cal. **Preserving citrus fruits.** After the core or seeds are removed, the fruit is put in cold water for twenty-four hours, then boiled for ten hours, then put in cold water for a week, dipped in boiling syrup for five minutes, and drained and dusted with fine sugar.

772,103. Isidor Kitsee, Philadelphia, Pa. Assignor one-half to Charles L. Hamilton, Wm. Penn, Pa. **Water-proofing paper.** The surface of the paper is nitrated by nitrosulphuric acid, and then treated with a solvent as acetic acid or amyl acetate.

772,129. William M. Burton, Chicago, Ill. Assignor to Standard Oil Co., same place. **Hydroxystearic acid.** Oleic acid is diluted with a paraffin oil, sulphuric acid added to make sulpholeic acid, which is steamed to produce hydroxystearic acid, which is dissolved in hot petroleum naphtha, cooled to recover the acid, filtered off, and dried.

772,132. Joseph Crossley, Trenton, N. J. **Filter cloth.** Made of pervious material, but having an opening in the middle provided with a surrounding rubber reinforce embedded in the cloth and vulcanized.

772,164. Otto Massinez, Wiesbaden, Germany. **Dechroming iron.** The metal is exposed to an oxidizing flame on an open-hearth furnace, then a mixture of iron ore, lime and open-hearth slag is added, proportioned to give less than 13 per cent. of chromic oxide, removing at intervals part of the slag and adding some of constituents so as to maintain the slag in a fluid condition.

772,181. Joseph D. Scott, Shields, England. **Heat insulating compound.** Powdered asbestos 70, powdered mica 20, starch and cement 10 parts each, to be mixed with water.

772,206. Henry S. Blackmore, Mt. Vernon, N. Y. **Separating alkali** salts from insoluble compounds. The powdered material is mixed with water in a vacuum whereby the air is removed, carbon dioxide at increased pressure then caused to act on the mixture, and the pressure alternated from high to low, the solution and residue being removed at intervals, and fresh material supplied.

772,237. Paul Jeanmaire, Mulhausen, and Rene Bohn, Mannheim, Germany. Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen, on Rhine, Germany. **Printing indanthrene.**

The fabric is printed with a mixture of indanthrene, tin salt and a thickener, and then passed into a bath of caustic soda.

772,247. Louis E. Miller, Paris, France. **Coating bricks,** etc., with carborundum. A compressed plate of powdered coating material is made and put in a mold, the powdered ceramic material applied to the back of the plates, and compressed, so as to adhere.

772,262. Frank J. Tone, Niagara Falls, N. Y. Self-**bonded carborundum article.** Ceramic articles are faced with carborundum bonded by oxidation and consequent cohesion of the particles.

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772,390. Carl Zimpel, Stettin, Germany. Apparatus for **recovering ammonium sulphate.** A tank with gas bell having an inner shorter cylinder and a central depending pipe reaching below the bottom and a feed-pipe for acid just through the cover, and a manhole in the cover, and bent overflow pipes in the cylinder walls.

772,439. Chas. S. Szekeley, New York, N. Y. Assignor to Metal Casting Co. **Mold coating.** Powdered French chalk, 20, kerosene and paraffin oil 40 each.

772,517. Samuel R. Kennedy, Philadelphia, Pa. **Milk-sugar.** Milk is condensed, the sugar crystallized out by refrigeration, centrifugated at 32° F., and washed with alkaline, cold water.

772,523. Agostino Lamanna, Baltimore, Md. **Cement.** Two parts each of pozzuolana and crushed stone or sand, and to each bushel of the mixture 2 pounds of rock salt.

772,560. Sylvain Eichardt, St. Fons, near Lyons, France. Assignor to Société Chimiques des Usines du Rhone. **Printing compound.** *o*-Nitrophenyllactoketone, and a soluble sulphonated carboxylic acid.

772,612. Wm. T. Gibbs, Buckingham, Can. **Decomposing refractory silicates.** The silicate is treated with a mixture of sulphuric and hydrofluosilicic acids.

772,646. Georg Ebert, Rixdorf, near Berlin, Germany. Assignor to Rudolf Piesbergen, Berlin. **Artificial leather.** Animal gelatin is mixed with glycerin, fatty oils, India-rubber solution and a filling, as barium white, and encased on both sides with a collodion film, the whole being rolled and hardened by formaldehyde, etc.

772,657. Wm. T. Gibbs, Buckingham, Canada. **Decomposing silicates.** Silicates are powdered, treated with hydrofluosilicic acid, and sulphuric acid.

772,666-7. Carl H. F. Muller, Hamburg, Germany. Both for **X-ray tubes,** the first has three electrodes in a right line, the second has five electrodes and a liquid vacuum regulating chamber.

772,712. Frank J. Friese and John E. Gilbert. **Casting brass.** About 5 per cent. of aluminum is added lastly to the charge.

772,775. Wilhelm Behagel and Gustav C. Schumann, Ludwigshafen, on Rhine, Germany. Assignors to Badische Anilin Co. Same place. Making **indoxyl compounds.** Hydroxyethylaniline is heated in a caustic potash melt with quicklime.

772,857. Ludwig Wolman, Elberfeld, Germany. Assignor to Elberfeld Co., New York, N. Y. **Trihydroxyanthraquinone dye.** A 1, 2, 5-trihydroxyanthraquinone consisting of red needles melting at 274° C., forming a triacetylized derivative by recrystallizing from glacial acetic acid, as yellow needles melting at 228° C. Soluble in sulphuric acid, turning blue on adding boric acid, dissolving blue in alcoholic caustic soda, which shows a characteristic spectrum with 3 bands in orange, yellow and green, dyeing chromed cotton blue violet.

772,862. Kristian Berkeland, Christiana, Norway. Making **nitrogen oxides.** An electric arc is created in a magnetic field and a current of air or other gases is caused to traverse the field, and the compounds of nitrogen formed are separated.

772,876. Robert K. Duncan, Washington, Pa. Decorating **vitreous ware.** A lead sub-borate is made by fusing a mixture of boric acid, and lead, with metallic oxides for color, and it is deposited on a heated vitreous article where it melts and adheres.

772,901–2. Cornelius J. Nolan, Toledo, Ohio. Assignor to Libbey Glass Co., same place. The first for apparatus for **fire-polishing glass,** by directing on it a blast containing combustible material and then a blast rich in oxygen, the second for the process of coating the surface with carbon, then burning it off.

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772,931. Richard Gley, Berlin, Germany. Assignor to Actien Gesellschaft fur Anilin Fabrikation, same place. **Sulphur lakes.** Sulphur dyes that form leuco compounds with alkaline sulphides are treated with metallic salts as barium chloride, and are then precipitated by an oxidizing agent as air or $H_2O_2$.

772,933. Byron B. Goldsmith, New York, N. Y. Finishing **patent leather.** After the preparatory coats a glossing coat is applied of a mixture of equal parts of drying oil and pyroxylin varnish composed of 5 per cent of pyroxylin in amyl acetate.

773,004. James M. Dennis, Richmond, Ind. Assignor three-eighths to Harry R. Dennis and Wm. H. Alford, same place. **Artificial fuel.** Humus 1200, virgin earth 442, sulphates of iron and magnesia each 25, sodium sulphate 15, and sodium chloride 10, solidified crude oil 200, manganese oxide 12, potassium nitrate 11, rosin 20 and lime 40 parts. Solidified oil is made by mixing rosin, creosote, saltpeter and lime with crude oil.

773,030. James Reany, Jr., Sherwood, Md. **Hydrating lime.** Quicklime and water are weighed out in combining quantities and mixed in a tumbler roll, then moved slowly over a screen and rapidly to a discharge.

773,034. Theodore G. Selleck, Chicago, Ill. Assignor to Acme Steel Co., same place. **Converting steel.** Low-carbon steel is surrounded with a carbonizing compound, the whole enclosed in a removable package of wood or paper, and conveyed into a converting zone of heat where the envelopes are removed from around the charge by combustion.

773,251. Emil Fischer, Berlin, and Joseph von Mering, Halla-on-the-Saale. Assignors to E. Merck, Darmstadt, all of Germany. **Dialkyl acetic acid ureide.** Dialkyl malonic acid is condensed with urea to a dialkyl acetyl urea, having the general formula, $(Alk)_2CH/CO/NH.CO.NH_2$, soluble in hot water and alcohol, insoluble in fixed alkali solution, and decomposed by hydrochloric acid at 100° C., to urea and dialkylacetic acid.

773,276. Erik V. Clausen, Norre Nebel, and Carl A. Heilmann, Skjaeiskor, Denmark. **Linoleum substitute.** An alkali metal caseinate and an alkali metal serum albuminate 50 parts each by weight, sulphur 10, and a filler 20.

773,281. Willis E. Everette, Tacoma, Washington. **Radium container.** An insoluble body of gelatinous ammonium chromate containing sodium chloride.

773,343. Otto Sachse, Luneburg, Germany. Assignor to Triplex Gesellschaft, für Soole Verdampfung in Vacuum, same place. **Sodium carbonate** is added to the brine in slight excess of the calcium present; the whole evaporated *in vacuo*, the soluble bye-salts removed by centrifuge, and the resulting liquor, rich in magnesium sulphate, added to brine before treatment with sodium carbonate.

773,346. Albrecht Schmidt and Otto Rhodius, Hochst-on-Main, Germany. Assignors to Meister Lucius und Bruning, same place. **Yellow sulphur dye.** *m*-Toluylene-diamine and an aromatic base are heated with sulphur and carbon disulphide, forming a brown powder, insoluble in water, alcohol, ether or benzene, but soluble in hot alkaline sulphide.

773,368. George Bower, St. Neots, and Frederick W. Gauntlett, London, England. Substitute for **lithographic stones.** A metallic plate is provided with a firmly adherent coat of magnetic iron oxide by a steam furnace.

773,395. Thomas Jones, Acme, Texas. **Purifying water.** Milk of lime is added to the water, and then a syrupy ortho-silicate of soda.

773,412. Laurent Naudin, Paris, France. Apparatus for treating **viscose skeins.** A tank containing extensible yarn

sticks over which is a spray pipe for dilute sulphuric acid, the skein-carrying shafts being adapted to rotate and to rise and fall.

773,421. Ernest D. Reed, Ann Arbor, Mich. Assignor to Royal S. Copeland, same place. **Artificial stone.** Sand, cement, and lime (equal parts) are mixed dry, then 2 pounds of copperas, and 1 pound each of copper sulphate, chrome alum, manganese chloride, litharge, and potassium carbonate, and 15 pounds sodium silicate are mixed with 40 gallons of water, and neutralized with sulphuric acid and potassium bichromate, then calcium fluoride and sulphuric acid are added, the whole mixed together, and treated at intervals with acetic acid solution containing hydrofluosilicic acid.

773,427. George R. Schmitt, Munich, Germany. **Plastic wall covering.** Waste paper pulp 100, water 30, linoxin 100, resin 35, and turpentine 4 are mixed and formed into slabs or strips.

773,450. Robert S. Anderson, Seattle, Washington. Assignor three-fourths to Walter F. Horner, Willis C. Meeker, and Hiram U. Woodin. **Alloys.** Copper 93 and tin 7 parts are melted together with 2 parts of copper sulphate added and 5 ounces of the mixture put with 2 pounds of aluminum, the whole melted and cast.

773,492. Robert E. A. Gans, Pankow, near Berlin, Germany. **Ignition material.** Cupro-barium tetrathionate and sulphur are heated together, and the resulting compound mixed with potassium chlorate.

773,494. Adolf Gutensohn, Southend, England. Compound for **purifying water.** Resin is heated and cooled, then mixed with soda-ash 4, caustic soda 4, and sodium silicate 1 part in water sufficient to make an almost transparent soap.

773,524-5. Wm. S. Rogers, Cleveland, Ohio. Assignor to J. C. Pearson Co., Boston, Mass. The first for a **coated nail,** and the second for **coating nails** with a compound of rosin, a metallic resinate, and a non-drying oil as fish or rosin oil.

773,529. George G. Seward, Holcombe Rock, Va. Assignor to Eimer & Amend, New York, N.Y. **Carbon analysis.** The substance is mixed with an oxidizing agent as $Na_2O_2$, confined in a crucible, and heated by an electric arc, the carbon dioxide collected in potassium hydroxide, dilute sulphuric acid run into the crucible and boiled to remove last traces of $CO_2$, purified air blown through the apparatus, and the alkali bulb weighed as usual.

WILLIAM H. SEAMAN.

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## GENERAL AND PHYSICAL CHEMISTRY.

**Chemical Combination of Oxygen and Hydrogen under Action of Radium Rays.** BY BERGEN DAVIS AND C. W. EDWARDS. *J. Soc. Chem. Ind.*, 24, 266, 267.—Hydrogen is evolved when radium acts upon water. The authors have succeeded in causing hydrogen and oxygen to combine, when the mixed gases are exposed to radiations from radium bromide.

Two small glass bulbs, of equal volume, were connected by means of a capillary tube, in which a globule of mercury served as an indicator. One bulb contained about 4 mg. of radium bromide, and was provided with two electrodes to measure the amount of ionization produced by the radium. The two bulbs were filled with a mixture of dried oxygen and hydrogen, and phosphorus pentoxide was placed in each bulb. A decrease in pressure registered by the motion of the globule of mercury towards the bulb which contained the radium salt, showed that $36 \times 10^{-1}$ cc. of gas was disappearing each second.

The amount of ionization which radium produced in the gas was measured by an electrometer. The presence of an electromotive force on the electrodes did not alter the rate of the chemical action. Since all of the ions formed were driven out by this electromotive force, it seems that the act of ionization itself and the ionic recombination give rise to the chemical combination. By the rate of leak of the electrometer, it was shown that radium sets free 2.2 electrostatic units of electricity in the gas per second. Let Q be the total set free per second, N be the number of ions produced in a second, and E be the charge on an ion, then $Q = NE$.

If the charge on one ion is $3 \times 10^{-10}$ E. S., then $N = \frac{Q}{E} = 7.3 \times 10^{-9}$ free ions produced per second. The number of molecules of gas which disappear can be calculated from the change in

volume per second, $36 \times 10^{-7}$ cc., if the number of molecules of gas per cubic centimeter is taken as $4 \times 10^{19}$. The value $n = 144 \times 10^{12}$ is obtained. If M represents the number of molecules of water formed per second, $M = 96 \times 10^{12}$. The ratio $M/n = 13,100$. That is, 13,100 molecules of water are formed for each physical ion produced in the gas by radium, a very large ratio, which increases with increase in temperature. LAUDER W. JONES.

**On the Nature of Radioactivity.** BY H. V. VON ZERNICOW-LOSS. *J. Frank. Inst.*, 157, 141.—The author suggests a modification of the hypothesis that an atom consists of a system of much more minute particles, electrons, having orbital motions of enormous velocity. The atom of lead is stable; the atom of radium is not. In a lead atom all of the "ions" (electrons) appear to move in finite orbits, either circular or elliptical. In an atom of radium some of the electrons appear to move in infinite orbits either parabolic or hyperbolic, with the result that these are thrown off from the focal spot of each system. The author thinks that latent heat of vaporization is partly used in changing finite into infinite orbits. It is thought that, in consequence, all expansive or gaseous matter should be more or less active. No experimental evidence is presented. H. N. McCOY.

**The New Theory of Matter.** BY A. E. OUTERBRIDGE. *J. Frank. Inst.*, 158, 411-420.—This abstract of a lecture by the author begins with an account of the earlier views of the nature of matter and includes an exposition of the theories of Lodge and of Balfour. H. N. McCOY.

**Improved Methods of Applying Radium.** BY HUGO LIEBER. *J. Soc. Chem. Ind.*, 24, 230, 231.—More than 95 per cent. of the radiations of radium consist of $\alpha$-rays. These rays are almost completely absorbed by the glass or aluminium tube in which the radium is usually contained when used for therapeutic purposes. The radium emanation, which is gaseous in nature, is also retained in the capsule. A large portion of the $\alpha$-rays is also absorbed by the freely exposed radioactive substance itself, except when used in very thin layers. The author uses radium in the form of thin coatings. The object to be coated is dipped in a solution of radium in a suitable solvent and then dried. The radium is left as an exceedingly thin film. Such solvents are used as have a tendency to soften and permeate the material which is to be coated. Thus, for celluloid, alcohol or amyl acetate is used. The film of radium is covered by a very thin film of collodion. The films are colored with an aniline dye which serves to show the extent of the coatings and also to indicate at once any accidental removal of any portion of the film. Celluloid rods so prepared may be boiled with water without removal of the radium coating. The coatings are thus easily sterilized. A delicate rod,

coated at its tip with radium bromide of 10,000 activity compared favorably in its effect on an electroscope with one gram of the same radioactive substance contained in a glass tube. These radium coatings are readily applied therapeutically.

H. N. McCoy.

**The Evolution of Matter as Revealed by the Radioactive Elements. The Wilde Lecture.** By Frederick Soddy. *Manchester Lit. and Phil. Soc.*, 48, Part II, 1–42.—The lecture presents a clear and comprehensive account of the phenomena of radioactive transformations and their explanation according to the disintegration hypothesis of Rutherford and Soddy. The remarkable experiments of Ramsay and the author on the spontaneous transformation of the radium emanation into helium are recounted in a most convincing manner. H. N. McCoy.

**The Doughty Springs, A Group of Radium-bearing Springs, Delta County, Colorado.** By Wm. P. Headden. *Amer. J. Sci.*, 19, 297–309 (see this *Rev.*, 27, 213). H. N. McCoy.

**On the Origin of Radium.** By H. N. McCoy. *Ber. chem. Ges.*, 37, 2641–2656; *Chem. News*, 90, 187–189, 199–201—It is highly probable that radium is not a permanent element. Its rate of decay is approximately 0.1 per cent. per year. It is therefore necessary to assume the continuous production of radium from some other form of matter. From the fact that radium is ordinarily found associated with uranium, which is also radioactive but decays only one-millionth as fast as radium, it is logical to assume that radium may be one of the successive decomposition products of uranium; thus: $U \rightarrow Ux \rightarrow Ra \rightarrow Ra\ Em \rightarrow$ etc. It is shown, theoretically, that for the equilibrium condition of a series of irreversible changes of the first order, such as the above is supposed to be, the mass of each product bears a constant ratio to that of the uranium. Calculation shows that the equilibrium condition should be reached in any uranium compound more than 5000 years old. Since most uranium ores are probably much older than this, it should be found that the ratios of the percentage of uranium to that of each of its decomposition products should be the same for all ores. Therefore, the radioactivity of every uranium ore, free from thorium, should be directly proportional to its percentage of uranium. This was found to be approximately true for 12 ores, the average deviation from the mean value of the ratio of the activity to percentage of uranium being 7.1 per cent. The ratio of activity to uranium content for pure compounds was also approximately constant, but the value of the ratio for the ores was over five times as great as for the pure compounds. The activity was measured electrically on half-gram portions spread over an area of 40 sq. cm. [This simple method of measurement is not strictly accurate since it

fails to consider the absorption of the rays by the radioactive substance itself. When this is done (McCoy: This Journal, 27, 391 (1905)) it is found that for the pure uranium compounds the activity is strictly proportional to the percentage of uranium. The same is true for the ores; but for equal uranium content the ores are 4.17 times as active as the pure compounds). The results indicate that not only radium but all of the radioactive substances found in uranium ores bear a genetic relationship to uranium. H. N. McCoy.

**The Relation of Physical Chemistry to Physics and Chemistry.** By J. H. van't Hoff. *J. Phys. Chem.*, 9, 81–89.—An address, delivered before the Section of Physical Chemistry of the International Congress at St. Louis, in which is reviewed the development of our ideas concerning matter and affinity in the light of physical science. The substance of the address does not admit of an abstract. C. A. Kraus.

**Physical Chemistry in the Service of Agriculture.** By F. K. Cameron. *J. Phys. Chem.*, 8, 637–647.—In this paper the author reviews what has thus far been accomplished in the application of physical chemical laws and methods to the problems of agricultural chemistry, at the same time pointing out further needs in this direction. C. A. Kraus.

**Future Developments in Physical Chemistry.** By Wilder D. Bancroft. *J. Phys. Chem.*, 9, 216–230.—An address delivered at the Philadelphia meeting of the American Chemical Society (1904) which does not admit of an abstract. The speaker sums up in the following words: "The future developments in physical chemistry will comprise a theory of concentrated solutions, further applications of the phase rule and of the theorem of Le Chatelier, a systematic study of organic chemistry, and a theory of catalysis." C. A. Kraus.

**Osmotic Pressure.** By George A. Hoadley. *J. Frank. Inst.*, 157, 437–442.—The author gives an account of the development of osmotic pressure measurements. He describes some of the methods used in preparing semipermeable membranes including those of Morse (this Review, 8, 438).

C. A. Kraus.

**Recent Investigations Bearing on the Theory of Electrolytic Dissociation.** By Louis Kahlenberg. *Phil. Mag.*, 9, 214–229.—The greater portion of this paper is a condensation of an earlier paper (this Review, 7, 156) and its review need not be repeated here. In the latter portion of the paper, however, the author attempts to supply a new theory of solutions. He considers chemical compounds to be not essentially different in nature from solutions and as being derived from the latter by applying

stress or duress in the processes of evaporation, crystallization, etc. In the author's own words: "The processes of solution and chemical action are then identical in character, and chemical compounds are merely the cleavage pieces of solutions placed under special stress or duress represented by the so-called purifying process." According to the views of the author, the molecular weights of salts in aqueous solutions are not abnormally low owing to dissociation, but, in consequence of an abnormally great affinity of the salts for the solvent, the vapor-pressure of the solvent is abnormally reduced. In like manner, the molecular weight of colloids is not abnormally high, but the affinity of the colloid for the solvent is very small and in consequence the vapor-pressure of the solution is that of the pure solvent. The action of osmotic membranes is likewise attributed to the affinity of the membrane for the solvent. The author alludes to results, as yet unpublished, according to which the osmotic phenomena in non-aqueous solutions depend upon the nature of the membrane and that of the liquids bathing it.

C. A. KRAUS.

**A Model Illustrating Hittorf's Theory of the Migration Velocities of Ions.** BY FREDERICK H. GETMAN. *Science*, **21**, 153–155.—The author describes a model for illustrating the motion of the ions. Painted wooden spheres, mounted upon a suitable rack, take the place of the customary graphical representation. The model should prove a time-saver to both instructor and student.

C. A. KRAUS.

**Determination of the Relative Velocities of the Ions of Silver Nitrate in Mixtures of the Alcohols and Water and on the Conductivity of Such Mixtures.** BY HARRY C. JONES AND H. P. BASSETT. *Am. Chem. J.*, **32**, 409–445.—The present investigation was suggested by the results of Jones and Lindsay, according to which the conductivity of the solutions of certain salts in mixtures of the alcohols and water is less than that of solutions in either of the pure solvents. Following a review of previous work on migration velocities, the authors give the results of a study of the conductivity of silver nitrate in mixtures of ethyl and methyl alcohols and water. Measurements were carried out at 0° and at 25°. In mixtures of ethyl alcohol and water no minimum occurs in the conductivity-composition curve at 25°, although there is an approach toward a minimum at 0°. In methyl alcohol and water a minimum occurs at both temperatures for compositions between 50 and 100 per cent. alcohol, the minimum occurring at higher composition with increasing concentration of solution and with increasing temperature.

A description is given of the apparatus used in determining the relative migration velocity of the nitrate ion in a silver nitrate solution for the details of which the reader must be referred to

the original. Measurements were carried out with solutions of 0, 25, 50, 75, and 100 per cent. methyl alcohol. It was found that at 25° the relative velocity of the anion is a maximum for 50 per cent. alcohol, while at 0° it is a minimum for the same composition. The concentration of the salt was 0.1 normal. The authors explain these results by means of the temperature coefficients of mobility of the ions and fluidity of the solvent.

C. A. KRAUS.

**A Study of the Conductivities of Certain Electrolytes in Water, Methyl and Ethyl Alcohols, and Mixtures of These Solvents. Relations between Conductivity and Viscosity.** BY HARRY C. JONES AND CHARLES G. CARROLL. *Am. Chem. J.*, 32, 521–583.—The authors make a study of the properties of mixed solvents with a view to discovering their interrelations. Conductivity measurements were carried out in mixtures of 25, 50, and 75 per cent. methyl alcohol in water, as well as in the pure solvents. At both 0° and 25° sodium iodide exhibits a minimum conductivity for from 50 to 75 per cent. alcohol, depending upon the concentration of the salt solution and upon the temperature. Cadmium iodide exhibits a minimum conductivity at 0° in the more concentrated solutions but not at 25°. Calcium nitrate exhibits no minimum either at 0° or at 25°. The conductivity of hydrochloric acid was determined in mixtures of from 50 to 100 per cent. alcohol, but the results are very irregular as are also those for sodium acetate in mixtures of acetic acid and water.

It was found that in solutions in mixtures of methyl alcohol and water the limiting value of the equivalent conductivity is reached at higher concentrations than in either solvent alone, this phenomenon being most pronounced in mixtures of 50.0 per cent. alcohol. The limiting value of the conductivity was determined for a number of salts in such a mixture and the degree of dissociation was calculated therefrom. The results seem to indicate a greater degree of dissociation in the mixture than in either water or methyl alcohol alone. According to the hypothesis of Dutoit and Aston, the dissociating power of a solvent is dependent upon the association of the solvent. Assuming direct proportionality the relation for comparable solutions becomes $\frac{\alpha}{x}=$constant ($\alpha=$degree of dissociation of solute, $x=$ association factor of salt), when such solutions are considered comparable in which the same number of molecules of solute are dissolved in the same number of molecules of the various solvents. Under these assumptions the authors determine the value of the constant for solutions in water and methyl and ethyl alcohols. The values obtained are in good accord and are approximately equal to 25. Using the value of the constant thus found they determine the association factor for a mixture of 50 per cent

methyl alcohol and water with the result that $\alpha = 3.96$, from which they conclude the possibility of a hydrate, $CH_3OH.3H_2O$.

The authors now seek an explanation for the form of the conductivity-composition curve of the methyl alcohol-water mixtures. This they find in the viscosity of the mixed solvent. The viscosity of a mixture of alcohol and water is shown to exhibit a maximum where the conductivity exhibits a minimum and moreover the effects of temperature and concentration on the viscosity and conductivity are shown to be in accord with each other. An extended comparison is made between the percentage change in the conductivity of the solution and the viscosity of solvent, with change in composition of the solvent, which further substantiates the relation between conductivity and viscosity.

The relation between viscosity, association of solvent and conductivity is discussed at length. This relation the authors seek to formulate in the following hypothesis: "The conductivities of comparable, equivalent solutions of binary electrolytes in certain solvents are inversely proportional to the coefficient of viscosity of the solvent in question and directly proportional to the association factor of the solvent." The definition of the term "comparable solutions" is that given above. Algebraically expressed, the above formulation gives us $\frac{\mu_v \eta}{x} = \text{constant}$, which may be put in the form $\frac{\mu \eta}{\alpha} = \text{constant}$, where $\mu_v$ is the equivalent conductivity at dilution $v$, $\alpha$ is the degree of dissociation of the electrolyte at this dilution, $\eta$ is the coefficient of viscosity and $x$ the association factor of the solvent. If the solute be completely dissociated, $\alpha = 1$, and $\mu_v = \mu_\infty$, whence we obtain $\mu_\infty \eta = \text{constant}$. The values of $\frac{\mu_v \eta}{x}$ are calculated for various salts dissolved in methyl, ethyl, and propyl alcohols and acetone. The values lie in the neighborhood of 0.14 and are quite concordant. Finally, the values of $\mu_\infty \eta$ are calculated for methyl and ethyl alcohols and acetone. The values obtained lie near 0.5 and are in good agreement where the data used as a basis for calculation are trustworthy. In the above-named solvents, the values, 0.567, 0.530, and 0.541, respectively, were determined for potassium iodide solutions at 18°. The authors fail to apply the above expressions to water solutions. For this solvent both $\frac{\mu_v \eta}{x}$ and $\mu_\infty \eta$ have a value fully twice as great as for the alcohols and acetone.

C. A. KRAUS.

**Electrolysis of Cobalt and Nickel Tartrates.** BY JAY E. ROOT. *J. Phys. Chem.*, **9**, 1-13.—Since the apparent decomposition potentials of cobalt and nickel in alkaline solution are 1.75 and 2.8 volts respectively, the attempt was made to separate cobalt and

nickel electrolytically for quantitative purposes. When the two salts occur in solution together it was found, however, that the differences in the decomposition potentials are much less. Pure cobalt could be obtained with potentials less than 2.1 volts. It was almost impossible, however, to precipitate the last traces of cobalt from the solution. This is ascribed to the formation of cobaltic salts. The solutions were made up from 10 grams of sodium tartrate and 50 cc. of sodium hydroxide of specific gravity 1.3, the whole being diluted up to 150 cc. after adding the nickel and cobalt sulphates. When nickel was not present the cobalt could be quickly and completely precipitated. The anode deposit consisted of cobaltic oxide, $Co_2O_3.3H_2O$, confirming the work of Coehn. C. A. KRAUS.

**The Aluminium Rectifier.** BY S. BARCLAY CHARTERS. *J. Phys. Chem.*, **9**, 110–147.—This paper is chiefly concerned with the efficiency of the aluminium rectifier. A study is made of various electrolytes with a view to determining the potential above which the current in the rectifier assumes considerable proportions. In order to control the temperature of the film, the anode was constructed of an aluminium tube, the temperature of which was maintained between 10° and 15° by means of a stream of water. With disodium phosphate as electrolyte, it was found that the rectifier retained its efficiency as high as 220 volts. When sulphuric acid served as electrolyte, the rectifier could not be used above 70 volts, while when citric acid served as electrolyte (100 grams in 1.5 liters of water) the rectifier could be used at 300 volts. With a citric acid solution of one-tenth the concentration above, the rectifier could be used above 500 volts without rupturing the anode film. Efficiency tests were carried out with phosphoric acid, of nearly maximum conductivity as electrolyte. The current was varied between 0 and 12 amperes. The current efficiency rises rapidly with increasing current until a value of approximately 80 per cent. is reached, when it remains practically constant. The voltage efficiency falls gradually from 50 to 30 per cent., while the energy efficiency falls from 40 to 20 per cent. These measurements were made on a 110-volt circuit. A mixture of phosphoric and sulphuric acids on a 55-volt circuit gave a much lower efficiency. C. A. KRAUS.

**Investigation of the Properties of Zinc Coatings.** BY C. F. BURGESS. *Elec. and Met. Ind.*, 3, 17–22.—A study is made of the protective power of hot dipped zinc coatings as compared with that of coatings electrolytically applied. Previously, comparison between such coatings had been made by determining the number of times that it was found necessary to dip the object in copper sulphate in order to expose the iron. It is shown that this method gives a measure of the thickness of the coating but not of its resisting power under normal conditions. Numerous tests

were made to determine a corrosive agent which would approach the conditions to which zinc coatings are normally subjected. A two-thirds normal (3.2 per cent.) solution of sulphuric acid was finally adopted as the corroding agent. The test strips were carefully prepared and in all cases they were cut so as to expose the iron around the edges. The strips were immersed in the solution and from time to time they were taken out and weighed, this operation being continued until all the zinc was dissolved. The loss of zinc thus determined was plotted with the time necessary for its solution. From the curves it appears that with a zinc coating of about 26 grams per square foot, the electrolytic coating requires nearly ten times as long for its solution as the dipped coating. Electrolytic coating exhibited as great a resistance to corrosion as dipped coatings of three times their weight. Some mechanical tests were made with the following results. Electrolytic coatings adhere to the iron more firmly than the dipped coatings and the electrolytic coatings are less brittle than the dipped, while the dipped coatings withstand repeated heating and cooling, better than the electrolytic ones. With regard to continuity, density, and resistance to abrasion no great differences were observed. C. A. KRAUS.

**The Solubility of Calcium Sulphate in Solutions of Other Salts.** BY F. K. CAMERON AND B. E. BROWN. *J. Phys. Chem.*, **9**, 210-215.—The solubility of calcium sulphate in solutions containing varying amounts of ammonium chloride and of ammonium nitrate was determined at 25°. In ammonium chloride solutions the solubility of calcium sulphate increases with increasing concentration of ammonium chloride until a maximum solubility of 10.9 grams per liter is reached in a solution containing 210 grams of ammonium chloride. The solubility then falls to 7.38 grams per liter for a solution saturated with both salts. In an ammonium nitrate solution the maximum solubility of calcium sulphate is 12.2 grams in a solution containing 750 grams of ammonium nitrate per liter, while in a solution saturated with both salts its solubility is 7.55 grams per liter. The following solubilities of calcium sulphate and of different salts in a solution saturated with both salts were determined, the solubililty of the calcium sulphate being placed in parentheses: NaCl—318.3 (5.52), $NaNO_3$ — 668.4 (7.16), $Na_2SO_4$ — 254.6 (2.58), $MgCl_2$ — 476.5 (1.09), $Mg(NO_3)_2$ — 615.1 (15.26), $NH_4Cl$ — 375.3 (7.38), $NH_4NO_3$ — (7.55). C. A KRAUS.

**The Heat of a Change in Connection with Changes in Dielectric Constants and in Volumes.** BY C. L. SPEYERS. *Am. J. Sci.*, **26**, 61–74.—An attempt is made to locate the source of chemical energy in the medium surrounding the molecule. An equation is deduced for the change in energy of a dielectric sphere embedded in a uniform and infinite electric field as the

volume and dielectric constants of the sphere change their values. A certain known function of the volumes and dielectric constants divided by the energy change should be a constant for all changes. The equation is applied to the evaporation of liquids and to the solution of one body in another. Some of the assumptions involved scarcely seem admissible in the light of present-day molecular theory. For example, the specific volumes of the molecules of a substance in the liquid and the gaseous states are assumed equal to the actual specific volumes of the liquid and the vapor respectively. The mean value of the constant from thirty-five determinations is calculated to 96 with a probable mean error of $\pm 72$, while the maximum variation is from $-24$ to $+315$. C. A. KRAUS.

**The Heats of Combustion of Atoms and Molecules.** BY LAWRENCE J. HENDERSON. *J. Phys. Chem.*, 9, 40–56.—The heats of combustion of neighboring homologues differ in most cases by a constant quantity although a few exceptions occur. When, however, the more general case is considered in which a hydrogen atom, combined with different elements, is substituted by a $CH_3$ group, the above simple relation seldom holds true. The author now considers the heat changes accompanying the substitution of a hydrogen atom united to carbon by the groups OH, O, and $NH_2$. The data are collected in tabulated form and discussed. The author summarizes his conclusions as follows: "The heat of combustion of an atom chemically bound in a molecule is dependent not only upon its nature and the nature of the atoms with which it is directly united, but also upon the nature and position of every other atom of the molecule.

"If there are not present within the molecule considerable energy relationships of unknown character, the energy of a valence is a variable and a function of all the atoms of the molecule and of their positions." The work is being continued.

C. A. KRAUS.

**On Certain Heats of Dilution.** BY J. E. TREVOR. *J. Phys. Chem.*, 9, 90–109.—The author treats mathematically the thermodynamic properties of a two-component system in a trivariant state, *i. e.*, in a one-phase state. The development does not admit of an abstract. C. A. KRAUS.

**A Contribution to the Theory of Solutions.** BY GEOFFREY MARTIN. *J. Phys. Chem.*, 9, 149–155.—The author seeks to explain the nature of solution by considering the forces brought into play when a foreign molecule is introduced among the molecules of a solvent. He applies his considerations more particularly to the explanation of osmotic phenomena, solubility limit, and electrolytic dissociation. C. A. KRAUS.

## INORGANIC CHEMISTRY.

**The Decomposition and Formation of Zinc Sulphate by Heating and Roasting.** BY H. O. HOFMAN. *Tech. Quart.*, 17, 333.—See this Journal, 27, R. 335. LAUDER W. JONES.

**The Oxidation of Sulphites by Iodine in Alkaline Solution.** BY R. HARMAN ASHBY. *Am. J. Sci.*, 19, 237–239.—Rupp (*Ber. chem. Ges.*, 35, 3694) proposed a method for estimating sulphur dioxide or sulphites in which iodine was used in the presence of sodium bicarbonate, and the excess of iodine was determined by means of standard thiosulphate. The author has tested the correctness of this method by experiment, and concludes that it has two sources of error: First, the sulphite is not completely oxidized by the iodine; second, some iodine is used up in secondary reactions. Since these two sources of error act in opposed directions, the result may be, in some cases, the happy balancing of opposed errors. LAUDER W. JONES.

**A Revision of the Atomic Weight of Strontium.** BY THEODORE W. RICHARDS. *Proc. Am. Acad. Arts and Sci.*, 50, 603.—A determination made by the analysis of pure strontium chloride showed that the atomic weight of strontium must be 87.697, if Ag = 107.93 and Cl = 35.455. A previous determination of the atomic weight of strontium (*Proc. Am. Acad. Arts and Sci.*, 30, 369) by the analysis of strontium bromide gave a value 87.663.

In an investigation, published by the Carnegie Institution, Richards and Wells will show that the value for the atomic weight of chlorine must be 35.473. If this new value is taken for chlorine, the atomic weight of strontium, determined by the analysis of strontium chloride, will be 87.661, which is almost identical with that found by analysis of the bromide. LAUDER W. JONES.

**On the Question of the Radio-activity of Thorium.** BY F. ZERBAN. *Ber. chem. Ges.*, 38, 557–559.—The author claims that all monazite sands which have been tested for uranium have been found to contain this element (0.02–0.1 per cent.). A sample of crystallized monazite showed the presence of about 0.02 per cent. uranium. The thorium from this mineral was radio-active. Thorium from minerals which contain no uranium (or radium) was found to be inactive, which leads to the conclusion that thorium in itself is not radio-active, but acquires radio-activity by induction (see this Journal, 26, 922, 1642).

LAUDER W. JONES.

**Radium and Radio-activity in General.** BY ROBERT H. BRADBURY. *J. Frank. Inst.*, 159, 225.—A lecture delivered at the Franklin Institute in November, 1904. The lecture is popular in character, and covers, in a very clear way, the fundamental facts concerning radio-activity. LAUDER W. JONES.

**Electrolytic Calcium.** By Joseph H. Goodwin. *Proc. Am. Phil. Soc.* (Phil.), 43, 381.—A new form of apparatus is described in detail, with exact dimensions of all the parts. The chief feature of the apparatus is an anode turned in a lathe from a 6-inch length of Acheson graphite electrode 6 inches in diameter. A bottom of solid calcium chloride was maintained in this anode by the cooling effect of a copper coil through which cold water circulated. The cathode was an iron rod five-eighths of an inch in diameter. It was so adjusted that it could be raised and lowered easily. The current was used to fuse the charge of calcium chloride except the bottom layer. The following working conditions are given:

| Volts. | Amperes. | Hours. | Grams of Ca. | Current efficiency. |
|---|---|---|---|---|
| 15 | 160 | 4 | 200 | 41.9 |
| 14 | 175 | 8 | 225 | 21.5 |
| 22 | 125 | 6 | 150 | 26.8 |
| 19 | 160 | 6 | 295 | 41.2 |

The metal was deposited in irregular masses, of which almost 98 per cent. was found to be calcium.

A study of the properties of the metal showed that it possesses greater stability than it has been supposed to have. Heated calcium may be filed or polished in a lathe without tarnishing. When cool, it tarnishes quickly. It may be heated red hot without igniting. While red hot, it may be plunged into water without reacting chemically to any great extent. At 300°-400°, calcium is soft, and can be hammered and rolled like lead. Its hardness is somewhat greater than that of sodium, lead, or tin, but about equal to that of aluminium. It is softer than zinc, cadmium, or magnesium. The specific gravity at 29.2° was found to be 1.5446. The specific resistance at 0° in microhms per centimeter cube was 3.43, which places calcium fifth from the head of the list of good conductors.

Lauder W. Jones.

## MINERALOGICAL AND GEOLOGICAL CHEMISTRY.

**On an Interesting Variety of Fetid Calcite and the Cause of Its Odor.** By B. J. Harrington. *Am. J. Sci.*, 19, 345-348.—The odor of the fetid calcite long since found in the Township of Chatham in the Grenville region, Canada, is shown to be due to hydrogen sulphide. The calcite, which in appearance and by analysis is nearly pure, has been found to contain fluid inclusions, suggesting the presence of hydrogen sulphide in a liquid condition or possibly dissolved in water. The amount found in two specimens was 0.016 and 0.021 per cent., equivalent to about 500 cubic inches of gas per cubic foot of the mineral. A white, more or less translucent, quartz associated with the calcite, likewise evolves hydrogen sulphide on abrasion, and it, too, contains fluid cavities. The results of a study of these inclusions are given, and also of experiments showing the mutual solubility of liquid carbon dioxide

and hydrogen sulphide and of liquid hydrogen sulphide and water under pressure. Several possible sources of the hydrogen sulphide in the calcite are suggested. On heating to 160° C. the calcite shows a strong, deep yellow phosphorescence.

W. F. HILLEBRAND.

**Moissanite, A Natural Silicide of Carbon.** BY G. F. KUNZ. *Am. J. Sci.*, 19, 396–397.—The author proposes the above name for the natural carborundum found by Professor Moissan in the Canyon Diablo meteoric iron. W. F. HILLEBRAND.

**Chemistry of California Petroleum.** BY PAUL W. PRUTZMAN. *Am. Geologist*, 35, 240–243.—This is from a much larger publication by the same author, entitled "Production and Use of Petroleum in California" (see this Journal, 26, R 480).

W. F. HILLEBRAND.

**Peridotite Dikes Near Ithaca, New York.** BY GEORGE C. MATSON. *J. Geol.*, 13, 264–275. W. F. HILLEBRAND.

**A Report on the Underground Waters of Louisiana.** BY G. D. HARRIS, A. C. VEATCH and others. *Geol. Survey of Louisiana, Bull. No. 1*, 164 pp.; maps, plates, figures.—In Part I of this report are a number of analyses of deep well waters from southern Louisiana. W. F. HILLEBRAND.

**Bibliographic Review and Index of Papers Relating to Underground Waters Published by the United States Geological Survey, 1879–1904.** BY MYRON L. FULLER. *U. S. Geol. Survey, Water Supply and Irrigation Paper, No. 120*, 128 pp.

W. F. HILLEBRAND.

**The Petroleum Fields of the Pacific Coast of Alaska, with an Account of the Bering River Coal Deposits.** BY GEORGE C. MARTIN. *U. S. Geol. Survey, Bull. No. 250*, 64 pp.; maps, plates, figures. Preliminary studies have shown that the region may yet be an important source of oil. Tests by Penniman and Browne, of Baltimore, of samples of Controller Bay, Oil Bay and Cold Bay show them to be refinery oils with paraffin base. The Bering River coal is the best yet found on the Pacific coast of North America. W. F. HILLEBRAND.

**A Correction.** BY C. R. VAN HISE. *J. Geol.*, 13, 280.—The author calls attention to a serious mistake in Monograph 47 of the U. S. Geol. Survey, "A Treatise on Metamorphism" (see this Journal, 27, R 4). The error is primarily one of computation and relates to the redistribution of sodium. The deficiency of soda in the sediments as compared with the original rocks should be 16,864,875,000,000,000 metric tons instead of the amount given on page 997, so that the total amount of soda in the ocean, instead of being a small fraction of the total deficiency for the sediments,

is 13.2 per cent. in excess of the deficiency. This error necessitates the modification of certain statements of page 998.

W. F. HILLEBRAND.

**Geology of the Hot Springs of Colorado and Speculations as to Their Origin and Heat.** BY ARTHUR LAKES. *Proc. Colorado Sci. Soc.*, **8**, 31-37.—The author is of the opinion that the geological conditions and surroundings of some of the best known hot springs in Colorado show that they derive their heat more from the great depth of their fissures, or from latent heat caused by folding or faulting of the rocks, than from the remaining heat of bygone volcanic activity.

W. F. HILLEBRAND.

**From the Borderland between Crystallography and Chemistry.** BY DR. VICTOR GOLDSCHMIDT. *Bull. Univ. Wisconsin, No. 108*, 38 pp.; figures.—An address delivered at Madison, Wisconsin, October 5, 1903, in which some of the problems that have in recent years engaged the speaker's attention with such important results, are clearly and simply presented. "They treat of etch-figures and dissolution forms, and of the methods by which, from these remarkable formations in the region of crystallography, conclusions can be drawn regarding the *structure of crystals* and the *mechanism of the process of dissolution.*"

W. F. HILLEBRAND.

**Mining Operations in the Province of Quebec for the Year 1904.** BY J. OBALSKI. (Publication of the) *Dept. of Lands. Mines and Fisheries*, 48 pp.; map, plates.—This report, which includes also an account of explorations in the Lake Chibogomo region, contains a few assays and analyses of manganese and iron ores, etc., and of a mineral water from the Abenakis springs, County of Yamaska.

W. F. HILLEBRAND.

**Contributions to Economic Geology, 1904.** BY S. F. EMMONS and C. W. HAYES, Geologists in charge. *Bull. U. S. Geol. Survey, No. 260*, 620 pp.; maps.—Like its predecessors (see this Journal, **25**, R 300, and **26**, R 239) in 1903 and 1904, this voluminous bulletin contains many (63) contributions by a large number of authors. The following papers contain matter of more or less interest to the chemist: *The Production of Gold in the United States in 1904*; WALDEMAR LINDGREN, p. 32. *The Production of Silver in the United States in 1904*; W. LINDGREN, p. 39. In both of these, statistics are given for the separate yields from placers, dry or quartzose ores, copper ores, and lead ores. *Ore Deposits of the Ouray District, Colorado*; J. D. IRVING, p. 50. *Preliminary Report on Ore Deposits in the Georgetown, Colorado, Mining District*; J. E. SPURR AND G. H. GARREY, p. 99. *The Ores of Goldfield, Nevada*; J. E. SPURR, p. 132. *Developments at Tonopah, Nevada, during 1904*; J. E. SPURR, p. 141. The last contains fairly exhaustive analyses by the reviewer of a primary and an oxidized

ore, extremely rich in both silver and gold. Of interest is the presence in them of 2.56 and 0.78 per cent. respectively of selenium, without any tellurium, and the probability that a part of the gold may exist in combination with selenium. *The Occurrence and Distribution of Tin*; FRANK L. HESS AND L. C. GRATON, p. 161. *Vanadium and Uranium in Southeastern Utah*; J. M. BOUTWELL, p. 200. Many new occurrences of these much-sought metals are noted and several were visited by the author. The area over which they have been found is very large, but as yet little is known as to the amount available. At least two crystallized minerals are vanadio-arseniates of copper, barium and calcium, of which one certainly is new and another seems to be a highly arsenical variety of calcio-volborthite. The examination of these minerals by the reviewer is in progress and will be continued. *Copper in the Red Beds of the Colorado Plateau Region*; S. F. EMMONS, p. 221. *Lead and Zinc Resources of the United States*; H. FOSTER BAIN, p. 251. *Iron Ores in the Brookwood Quadrangle, Alabama*; ERNEST F. BURCHARD. *Limonite Deposits of Eastern New York and Western New England*; EDWIN C. ECKEL, p. 335. *So-Called 'Iron Ore' Near Portland, Oregon*; J. S. DILLER, p. 343. *The Warrior Coal Basin in the Brookwood Quadrangle, Alabama*; CHARLES BUTTS, p. 357. *Progress of Coal Work in Indian Territory*; JOSEPH A. TAFF, p. 382. *Coal in Washington near Portland, Oregon;* J. S. DILLER, p. 411. *Coal in Clallam County, Washington*; RALPH ARNOLD, p. 413. *Coal in Nicholas Quadrangle, West Virginia*; GEORGE H. ASHLEY, p. 422. *The Coal of the Black Hills, Wyoming.* N. H. DARTON, p. 429. *The American Cement Industry*; E. C. ECKEL, p. 496. *Cement Resources of Northeast Mississippi*; A. F. CRIDER, p. 510. *Portland Cement Resources of New York*; E. C. ECKEL, p. 522. *Cement Materials of the Valley of Virginia*; R. S. BASSLER, p. 531. *Economic Value of Hot Springs and Hot-Springs Deposits*; W. H. WEED, p. 598. W. F. HILLEBRAND.

**Preliminary Report on the Geology and Underground Water Resources of the Central Great Plains.** BY N. H. DARTON. *U. S. Geol. Survey, Professional Paper No. 32*, 433 pp.; maps, plates, figures.—The chemical matter of this report is restricted to a few analyses, which have mostly appeared in other publications already noticed in this review. W. F. HILLEBRAND.

**Description of the Silverton [Colorado] Quadrangle.** BY WHITMAN CROSS, ERNEST HOWE and F. L. RANSOME.—This is the descriptive text accompanying the *Silverton Folio of the Geol. Atlas of the United States*, issued by the Geol. Survey. The portions relating to economic geology are condensations from Bulletin 282 (this Journal, 24, R 383), but that part treating of the geography and general geology of the quadrangle, by Cross and Howe, contains much that has not been hitherto published. Full descriptions are given of the many igneous rocks occurring therein,

accompanied by analyses, by chemists of the Survey, of some of them: Quartz latites, pyroxene andesites and monzonites.

W. F. HILLEBRAND.

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## ANALYTICAL CHEMISTRY.

**The Use of Tannic Acid in Determining Alumina.** BY ROBERT E. DIVINE. *J. Soc. Chem. Ind.*, **24**, 11.—Aluminium hydroxide is precipitated in a form that may be readily filtered and washed if a small amount of tannic acid is present in the solution when the ammonium hydroxide is added. The presence in the solution of chlorides of calcium, magnesium, sodium and potassium does not affect the accuracy of the determination of the alumina and the subsequent determination of lime and of magnesia is not influenced by the tannic acid in the solution.

A small amount of ferric hydroxide precipitated with the alumina does not interfere with filtration, but pure ferric hydroxide will not filter readily in the presence of tannic acid.

B. S. CUSHMAN.

**The Quantitative Estimation of Nitric Acid and Nitrates.** BY WILLIAM H. EASTON. *Chem. Eng.*, 1, 142-145.—When a solution of nitric acid or a nitrate acidified with sulphuric acid is electrolyzed the nitric acid is quantitatively reduced to ammonia, provided that copper sulphate is also present in the solution. The proper conditions for estimating a quantity of nitrogen as $N_2O_5$, equivalent to 0.5 gram of potassium nitrate, are as follows:

| | |
|---|---|
| Dilution | 150 cc. |
| Copper sulphate | 0.5 gram. |
| Sulphuric acid (sp. gr. 1.06) | 30 cc. |
| Anode | Spiral of platinum wire. |
| Cathode | Dish or plate of platinum or copper |
| Amperes | 0.15 to 3.0. |
| Volts | 3 to 8 depending on amperage. |
| Time | 1 hr. 15 min. for 3 amperes.<br>8 hrs. 30 min. for 0.15 ampere. |

When the decomposition of the nitric acid is completed the solution, which now contains the nitrogen as ammonium sulphate, is treated with an excess of potassium hydroxide and the ammonia thus set free is distilled into a known amount of standard acid. About forty minutes will be required to boil out the ammonia obtained from 0.5 gram of potassium nitrate.

Vortmann suggests the use of known amounts of copper sulphate and sulphuric acid and the determination, by titration, of the excess of sulphuric acid remaining free in the solution after the reduction of the nitrate. The nitrogen is then calculated from the amount of acid neutralized. The precipitation of the copper must

be complete and the liquid must be siphoned out of the beaker while the current is still on to prevent any re-solution of the copper. The copper sulphate is best standardized by electrolyzing a known volume and titrating the acid after the complete precipitation of the copper. B. S. CUSHMAN.

**Use of Crude Oil For Fire Assaying.** BY F. C. BOWMAN. *Chem. Eng.*, 1, 138-141.—A complete description, with drawings, of the furnace and burner is given and the cost of oil, per assay, is said to be about one-third that of coke. B. S. CUSHMAN.

**Apparatus for Sampling Cement.** *Chem. Eng.*, 1, 161-162.—This apparatus was devised and patented by J. Blodget Brittain the well-known English chemist, and consists of a small iron pipe of about $\frac{3}{8}$-inch bore closed and drawn down to a point and pierced with a number of small holes at one end, a vacuum collecting drum provided with a gauge and an air-pump. The different parts of the apparatus are connected by rubber tubes which may be closed by screw-clamps.

In taking a sample the drum is exhausted with the pump until a vacuum, equal to some 18 or 20 inches of mercury, is obtained. The pipe is then thrust down into the cement and on opening the clamp on the tube which connects the pipe with the drum the cement is drawn over into the drum. The limit of depth from which the samples may be taken is about 6 feet. B. S. CUSHMAN.

**Tables for Use with the Iodine Method for Copper and the Ferrocyanide Method for Zinc.** *Chem. Eng.*, 1, 186-190.—Two of the tables show the amount of thiosulphate or ferrocyanide required to make the standard solutions and the third gives the percentage of metal corresponding to the volume of solution used in the titration. The various substances used in standardizing the solutions are discussed and examples illustrating the use of the tables are given. B. S. CUSHMAN.

**Analysis of Calcines.** BY JOHN P. WALKER. *Eng. Min. J.*, 79, 285.—The accuracy of the statement (*Eng. Min. J.*, 77, 922) that calcines contain undecomposed pyrites having been questioned by J. W. Richards and also by A. T. French, the author shows by further experiments that the calcines do contain pyrites. He also states that his method of analysis was not proposed for all calcines and that it is sufficiently accurate for metallurgical purposes in the case of calcines of the Butte region.

B. S. CUSHMAN.

**Equipment of a Laboratory for a Smelting Plant.** *Electrochem. Ind.*, 3, 101-103.—This article is an abstract of an illustrated description of a laboratory for metallurgical chemistry and technical analysis built for a pyrite smelter. The original paper was presented by Herbert Haas at the Lake Superior meeting of the American Institute of Mining Engineers. B. S. CUSHMAN.

**On a Scale of Color Values and a New Photometer.** By A. H. Munsell. *Technology Quarterly*, 18, 60 (1905).—A patented instrument for determining the degree of light reflected or transmitted by a sample, by comparing it with the intensity of light from a standard source which is adjusted by a calibrated shutter. He thus determines by comparison the value of reflected color, of transmitted color, the illuminating power of light sources of the same or different colors, diffused light in a room and the relative sensitiveness of each eye to light and color. The instrument is put up in a portable box. W. C. Geer.

**An Improved Portable Gas Generator.** By Herbert N. McCoy. *Ber. chem. Ges.*, 37, 2534-2536.—The accompanying figure represents a portable generator, having only glass parts and rubber stoppers. It consists of three principal pieces with ground joints. The lowest part has a capacity of about 2 liters. The glass tube *C*, which passes through a rubber stopper closing the lower opening of the middle vessel, is of about 8 mm. internal diameter, and has near its upper closed end a hole 0.7 to 1.5 mm. in diameter. When the stop-cock *A* is opened, gas flows at once and acid flows through *C* on to the solid. The flow of acid is regulated automatically by the flow of gas through *A*. The very small volume of gas (20 to 100 cc.) formed after closing *A* collects in the middle vessel. The completely exhausted acid is drawn off through the cock *B* whenever it has accumulated to a depth of 3 or 4 cm. The apparatus is continuous in action and completely exhausts all of the acid used. It has been thoroughly tested with highly satisfactory results for the generation of carbon dioxide, hydrogen and hydrogen sulphide. Hydrochloric acid 1 : 1 is used. When pure zinc, in sticks, is used it is advisable to add a little copper sulphate to the first charge of acid, to render the zinc more active. The generator may be obtained from Bausch and Lomb, Chicago. H. N. McCoy.

## METALLURGICAL CHEMISTRY.

**New Steel Plant of the Illinois Steel Co.** *Iron Trade Review*, March 2, 1905.—A well-illustrated detailed description of seven new 50-ton stationary open-hearth furnaces, with details also of gas-producers plant, soaking pits, blooming-mill, boilers, engines, etc. J. W. Richards.

**Steel and Wrought Iron Pipe.** By F. N. Speller. *Iron Age*, March 2, 1905.—A comparison of the resistance to corrosion of these materials, with photographs, showing the relative corrosion after 16 and 64 weeks' exposure, on samples tested in aerated distilled water by the U. S. Navy Department. The pitting and corrosion were about equal on wrought iron, Bessemer steel and open-hearth steel. J. W. Richards.

**Production of Open-hearth Steel in 1904.** *Iron Trade Rev.*, March 16, 1905.—Complete returns obtained by the American Iron and Steel Association, show an output in the U. S. of 5,907-666 gross tons, of which over 70 per cent. was made in Pennsylvania. The basic process produced 85 per cent. of the total. Of this metal, 302,334 tons were run into commercial steel castings, of which 98,919 tons were made in basic furnaces, and 203,415 tons in acid furnaces; the latter item, in fact, represented one-fifth of all the acid open-hearth steel made. J. W. Richards.

**Producing Iron Electrolytically.** *Iron and Mach. World*, March 11, 1905.—The Carnegie Institution has appropriated $2,500 to Prof. C. F. Burgess, of the Department of Applied Electro-chemistry, at the University of Wisconsin, to aid him in carrying on investigations on the manufacture and properties of pure iron and its alloys. Already half a ton of pure iron has been made, in which, after heating to drive off some hydrogen, analysis fails to reveal any impurities. There is already a demand for such iron for scientific purposes and electrical instruments, and by using it in making alloys much light may be thrown upon the influence of impurities upon iron. J. W. Richards.

**The Butte Copper Mines and Smelters.** By D. E. Woodbridge. *Iron Age*, February 16, 1905.—A general account of the history and working of this great mining and smelting district, which mines and treats 12,000 tons of copper ore daily.

J. W. Richards.

**Cyanidation of Silver in Mexico.** By H. G. Elweo. *Eng. Min. J.*, March 16, 1905.—Tailings from the patio process containing silica 77, lime 7, sulphur 5, iron 4, zinc 3, copper 1 per cent., and silver 16 ounces, gold 0.1 ounce per ton was treated as follows: 25 tons of tailings were put into leaching tanks and washed twice with water, with 0.2 per cent. of lime sprinkled over the surface between these washes. Then 10 tons of 0.5 per cent. solution of potassium cyanide were run in from below until the tailings were covered 4 inches deep; the vat stood twelve hours, and the solution was then drained out into zinc shaving precipitating boxes. This was followed by a second washing with 10 tons of 0.25 per cent. solution, and by three more washings with like amounts of 0.25 per cent., 0.25 per cent., and 0.12 per cent. solution, finishing with a water wash of ten tons. The tailings contained 4 ounces

silver and only a trace of gold, showing extractions of 75 and 100 per cent. respectively. Two pounds of cyanide were used per ton of ore, which, with labor and all other costs, made a total cost of $0.90 per ton, while the value of the gold and silver extracted was $8.00 per ton. On another ore, an extraction of only 60 per cent. of its value was made by pan amalgamation, at a cost of $4.90 per ton, while cyanidation extracted 80 per cent. of the values at a cost of $0.75 per ton. A concentrate from Frue vanners containing 200 ounces of silver per ton was roasted with 8 per cent. of salt at a cost of $1.04 per ton, then cyanided by agitation for $1.45 per ton, thus extracting 90 per cent. of its silver at a cost of $2.49 per ton. Prices given are in gold. J. W. RICHARDS.

**The Manufacture of Silicon Bronze Wire.** BY E. S. SPERRY. *Brass World,* March, 1905.—Silicon reduces and removes the oxide of copper which may be dissolved in copper, and the oxide of tin which may also be present in bronze. The usual amount of oxygen in refined copper is 0.01 to 0.02 per cent., in re-melted copper 0.05 per cent. The latter quantity requires the theoretical addition of 0.05 per cent. of silicon in order to combine with and remove it, and this quantity is sufficient for all classes of silicon bronze for wire. The silica formed floats up quickly and forms a slag; if an excess of silicon is used, it remains in the metal and impairs its conductivity. Aluminum acts similarly, but the alumina formed, rising to the surface, is infusible, or at least, does not form a fusible slag, and gives rise to a mushy mass on the surface of the metal. Any excess of aluminum used is oxidized rapidly during the pouring of the metal, while it is exposed to the air, and the alumina formed being carried into, and mixed with the metal is entangled in the solidifying metal, unless the casting is a large one, and may produce a dirty ingot or billet. Phosphorus acts similarly to silicon, and produces a slightly clearer casting, but any excess of it used reduces the conductivity of the metal more than an excess of silicon. Standard silicon bronze containing 98.55 per cent. copper, 1.40 per cent. tin, and 0.05 per cent. silicon is used, but very little silicon remains in the final metal. The tin increases the strength. The mechanical properties are:

| | Annealed. | Hard drawn |
|---|---|---|
| Electrical conductivity (Mathiesen's standard) | 41 | 40 |
| Tensile strength per square inch, in pounds,... | 43000 | 92800 |
| Elongation in eight inches, per cent.......... | 34 | 1 |
| Reduction of area, per cent.................. | 85 | 68 |
| Twists stood in six inches.................. | 119 | 8 |

Copper of highest electrical conductivity, free from arsenic and antimony, must be used, and iron stirrers must not be used, but plumbago rods, since silicon attacks iron. After the copper is melted the silicon is added; its oxidation raises the temperature of the bath, since the reduction of cuprous oxide by

silicon evolves heat. The tin is then added, the bath stirred, the heat increased, the silica floats to the top, and the metal is poured into a 4-inch square billet, which is rolled hot down to a $\frac{3}{8}$-inch rod, and then annealed. The moulds are oiled with lard or fish oil. The rod is then drawn to the wire required. "Phono-electric" wire is the same as the alloy described. The silicon copper used occurs in commerce with 14 per cent. of silicon, in ingots weighing 15 to 20 pounds; with higher silicon the alloy is so brittle that there is a large waste in using it; 10 per cent. alloy is also suitable, and it is easy to calculate the quantity required. Up to 0.5 per cent. of iron is usually present in it, but does no harm. J. W. RICHARDS.

**Black Nickel Plate.** BY C. H. PROCTOR. *Metal Industry*, February, 1905.—Eight ounces of nickel salts and three ounces of ammonium sulphate are dissolved in a gallon of water, and if acid, neutralized with ammonia carefully added. Two ounces of potassium sulphocyanide are then dissolved in a small amount of hot water and added to the nickel solution. Nickel anodes are used and a current of the same strength as for bright nickel plating. If a better conducting bath is needed, 1 or 2 ounces of acid sodium sulphite are added to each 10 gallons of solution. The articles are polished, cleaned, and then plated, a beautiful black deposit coming down on polished surfaces, and a dark steel finish on dead surfaces. The deposits can be polished, if desired, and wear well. J. W. RICHARDS.

**Sterline.** BY E. S. SPERRY. *Brass World*, March, 1905.—A white metal resembling silver has recently appeared on the market, with the above name. An analysis shows it to contain copper 68.52 per cent., zinc 12.84, nickel 17.88, iron 0.76, lead trace, manganese none, silver none. Manganese serves as an admirable carrier for introducing iron into such alloys. If an alloy of 4 parts iron to 1 of manganese is melted along with the copper and nickel, all the iron will alloy homogeneously with the latter, making an alloy free from hard nodules, while the manganese will all disappear from the alloy in one to four meltings. (If a zinc-iron alloy is used, similar results as to the homogeneous alloying of the iron are obtained.—Abstractor).

J. W. RICHARDS.

**The Royal Copper Finish.** BY E. S. SPERRY. *Brass World*, March, 1905.—This is an enamel-like finish of red cuprous oxide, whose manufacture has, until recently, remained secret. Two methods are used: The saltpeter or niter method and the lead-plating method. Pure saltpeter crystals are taken, melted in an iron pot, and the article, which must be either of copper or else heavily copper-plated, is dipped into it and left in not longer than one minute, when it is removed and dipped immediately into

paraffin oil, which prevents the staining which occurs if water is used. The coating will be discolored if cooled in air, by the formation of black copper oxide. The paraffin oil has so high a flash-point that it does not ignite. The right temperature for the melted niter is 593° C. (1,100° F.); below this point the color produced is poor, above, the black oxide forms. This heat is a very low red, and can be determined satisfactorily when once seen, by a good observer; it is better to have a Le Chatelier pyrometer. The best way is to immerse in the niter small strips of metal similar to the article to be treated, and see when the bath is at the proper heat by the right color being produced on the test-piece. A hemispherical iron kettle, heated by gas, or crude oil blast is used. After the articles are removed from the melted paraffin they are wiped off with a soft cloth, buffed on a soft wheel with rouge, and then lacquered. In the lead-plating method, the articles are first cleaned in the usual manner for the removal of grease, then polished, if a high finish is wanted, then immersed in a lead-plating bath and plated with lead, using a moderately strong current until fuzzy lead crystals begin to appear. The solution is made by dissolving 7 ounces of caustic potash in 2 quarts of water, adding 5 ounces of litharge and boiling half an hour; settle, pour off the clear liquid, and dilute to 4 quarts. When the articles are uniformly plated with lead, wash thoroughly in hot water, rinse in alcohol, let dry, and then heat to redness before a blowpipe or in a muffle with a good air supply. The heat is raised to redness, and then the article let cool in air; the surface is then dead black. The article is then buffed with a soft buff and rouge, taking off the black and revealing a rich ruby-red finish beneath. This finish is so hard and durable as scarcely to need lacquering. Copper gives the best finish; brass articles must be first heavily copper-plated, for twenty to thirty minutes in a copper cyanide bath, and some sixty minutes in a copper sulphate bath. J. W. RICHARDS.

**Fourdrinier Cloth.** *Brass World*, March, 1905.—This is metal cloth woven of fine brass wire, and used in paper-making for draining the pulp. The standard mixture for the metal used is: copper 15 per cent., zinc 15 per cent., with the addition of 0.38 per cent. of tin. Only the best lake copper and Bertha spelter are used, and the wire is drawn to No. 24 in ordinary dies, and then down to 0.005 inch diameter through diamond dies, before weaving into the cloth. J. W. RICHARDS.

**The Hanson and Van Winkle Mechanical Electroplating Apparatus.** *Iron Age*, February 16, 1905.—Consists of circular wicker baskets, revolving on horizontal axes, into which the small articles to be plated, weighing up to 500 pounds, may be placed and revolved, in the depositing solution. Ten to fifteen minutes gives the metallic coating desired, all the small pieces

being uniformly coated, because of being continually tumbled around during the rotation of the basket. Anodes are hung outside the wicker barrels. J. W. RICHARDS.

**Core Sand Binders.** BY J. S. ROBESON. *Iron Age*, February 9, 1905.—These are the materials used to hold together sand cores; those in use are dextrin, flour, rosin, patent mixtures, fish oil, glue, gluetrin, linseed oil, molasses, various oil mixtures, rosin oil, sour beer. It should mix easily with the sand, pack easily, leave the core box easily and clean, stand alone before baking, bake quickly, stand rough handling when baked, be weak enough to yield to the contraction of the iron casting, be porous enough to permit gases to escape freely, not stick to the casting. Loamy sands and gritty, angular sands work best. Gluetrin is a corn product, and 1 part of it mixed with 2 parts of water and sprayed on 70 parts of sand, makes a fine core, at a cost of $0.50 for binding-material per ton of sand. J. W. RICHARDS.

**Metallurgical Calculations, I.** BY J. W. RICHARDS. *Electrochem. and Met. Industry*, March, 1905.—This is the first installment of a serial which is intended to run for at least a year. The subjects to be included within the treatise are as follows: The chemical equation, weights and volumes of gases, combustion, theoretical flame temperatures, thermochemical calculations at high temperatures, furnace efficiencies, chimney draft, transmission of heat through furnace walls, producer gas, water gas, mixed gas, regenerative gas furnaces, gas engines, cupolas, blast-furnaces, hot-blast stoves, blowing engines, Bessemer converters, the open-hearth steel process, electric furnaces, electrolytic furnaces, electrolytic refining, pyritic smelting, condensation of metallic vapors. The first article discusses the chemical equation, the weight and volume relations of equations, the calculations of volumes of gases at different pressures and temperatures, and concludes with three practical problems dealing with the calculation of the calorific power of a bituminous coal, Pittsburg natural gas, and the amount of air needed to oxidize the impurities in a Bessemer blow. J. W. RICHARDS.

**High Temperature Measurements.** *Metal Industry*, February, 1905 (*from Bull. U. S. Geol. Survey*).—Measurements made recently at Washington, for comparison with those of the German Bureau of Standards, gave the following values:

Melting-point of:

| | German values. | U. S. Survey determinations. |
|---|---|---|
| Cadmium | 321.7° | 321.7° |
| Zinc | 419.0° | 420.0° |
| Silver | 961.5° | 962.2° |
| Copper (in air) | 1064.9° | 1065.3° |
| Copper (in reducing gas) | 1084.1° | 1083.6° |

J. W. RICHARDS.

**Equipment of a Laboratory for a Smelting Plant.** By H. Haas. *Electrochem. and Met. Industry*, March, 1905 (Read before The American Institute of Mining Engineers).—An illustrated description of a works laboratory 18 by 48 feet, for assaying and quantitative metallurgical analyses. The cost was $525, not including the hood, chemical apparatus and supplies. The details will well repay any one who has the arrangement of a laboratory in view. J. W. Richards.

**Granulating Metals.** *Brass World*, March, 1905.—A tank of water is provided with an inclined board at one end, dipping under the water and adjustable at any desired angle. A rapid current of water flows from the nozzle down the board, into the tank. The melted metal is poured into the water, striking the board at varying depths and with varying supply of water from the hose, thus producing shot metal varying from bean size to larger or very small feathers. J. W. Richards.

**A New Crucible Material.** *Brass World*, March, 1905.—The "white stuff," produced in a carborundum furnace, a non-crystalline material, is mixed with water to make it plastic, and then moulded into crucibles, fire-bricks, etc., and baked in a regular kiln such as is used for pottery-burning. The heat alone bonds it into a solid, durable refractory material, especially serviceable in brass manufacture. J. W. Richards.

**The Making of By-Product Coke.** By E. A. Moore. *Eng. Min. J.*, March, 2, 1905.—Description of the coking plant of the Camden Coke Co., at Camden, N. J. The poor gas obtained is burned under the ovens, but before burning it is washed with tar oil, whose strong affinity for benzene extracts all the illuminants from the gas; the benzene solution is then heated by steam in a retort, expelling the benzene, toluene, etc., which then pass into the rich, illuminating gas, and the tar oil is left ready to be used over. In this way the illuminants from the poor gas are saved, and the rich gas made better. J. W. Richards.

**The By-product Coke Oven.** By W. H. Blauvelt. *Iron Trade Review*, March 23, 1905 (Read before the Western Society of Engineers, Chicago).—An interesting lecture, describing at length the stamping of coal dust into cakes before charging into the ovens, the working of the ovens, treatment and marketing of the volatile products, coal tar, ammonia, illuminating gas, etc. The coke is said to contain less per cent. of ash and phosphorus than bee-hive coke, when made from the same coal, and to be in better-shaped pieces. J. W. Richards.

## ORGANIC CHEMISTRY.

**On Bilirubin, the Red Coloring-Matter of the Bile.** By W. R. Orndorff and J. E. Teeple. *Am. Chem. J.*, **33**, 215-250.—

Pure bilirubin has the formula $C_{32}H_{36}N_4O_6$ and not $C_{16}H_{18}N_2O_3$. It unites with diazonium compounds, in acid or neutral solution, to form monazo and disazo derivatives of the type $C_{32}H_{35}N_4O_6(N_2R)$ and $C_{32}H_{34}N_4O_6(N_2R)_2$. The monazo derivatives are formed in much smaller amount than the disazo, are more soluble in alkalies and not precipitated from alkaline solution by carbon dioxide, but are less soluble in most neutral solvents (carbon disulphide, chloroform or ethyl acetate). Their solutions show no absorption bands. The disazo derivatives show characteristic absorption bands. Their alkaline solutions are precipitated by carbon dioxide. The existence of these two series of azo derivatives shows that the molecular formula of bilirubin must be $C_{32}H_{36}N_4O_6$, and this was corroborated by the determination of the molecular weight of tribrombenzenedisazobilirubin. Bilirubin is apparently a derivative of pyrrol. EXPERIMENTAL—I. *Preparation and Analyses of Bilirubin.*—The bilirubin was prepared from ox-gallstones. As usually obtained, it is a mixture of at least two substances: A compound, $C_{32}H_{36}N_4O_6$, for which the name bilirubin is retained, and a small amount of a substance more soluble in chloroform and containing less nitrogen. By recrystallization the bilirubin, $C_{32}H_{36}N_4O_6$, was obtained pure. II. *Properties of Bilirubin.*—Bilirubin crystallizes from chloroform or dimethylaniline in orange-yellow or reddish needles or plates, probably of the monoclinic system. It has weak acid properties, dissolves readily in dilute solutions of alkalies or alkaline carbonates, more slowly in concentrated solutions, and is reprecipitated by carbon dioxide from its solutions in dilute alkalies. Its chloroform solution is decolorized when shaken with dilute alkali and its ammoniacal solution does not reduce ammoniacal silver nitrate solution (therefore no aldehyde group is present). III. *Attempts to Determine the Presence of Alkyloxy and Alkylimide Groups in Bilirubin.*—No alkyloxy or methylimide groups could be detected. IV. *Reduction of bilirubin* with zinc dust or hydriodic acid gave haemopyrrol, while sodium amalgam yielded hydrobilirubin. The addition of bromine water to an aqueous alcoholic solution of the latter decolorized it with separation of a voluminous yellow precipitate. V. *Azo Compounds of Bilirubin.*—With tribrombenzene diazonium acid sulphate, bilirubin yielded both a monazo and a disazo combination. The former gives a red, the latter a beautiful purple color with caustic potash. Analyses of these azo compounds showed them to have the composition $C_{32}H_{35}N_4O_6(C_6H_2Br_3N_2)$ and $C_{32}H_{34}N_4O_6(C_6H_2Br_3N_2)_2$, from which it would follow that the correct formula for bilirubin is $C_{32}H_{36}N_4O_6$ instead of $C_{16}H_{18}N_2O_3$, a conclusion which was supported by molecular weight determinations of the disazo compound above. The latter crystallizes from glacial acetic acid in large well-formed rosettes, almost black in color, and with a peculiar bronze luster. It gives a fine blue color with concentrated hydrochloric or sulphuric acid. In alcoholic potassium hydroxide

solution it shows a well-defined absorption band between $\lambda = 606$ and $\lambda = 536$, while in alcoholic hydrochloric acid the band lies between $\lambda = 573.5$ and $\lambda = 495.5$, and is weaker and less sharply defined. *Azo Compounds Formed from Bilirubin with Diazonium Acetophenone Salts.*—Acetophenone diazonium acid sulphate likewise forms both monazo and disazo combinations with bilirubin. The latter crystallizes from carbon disulphide in reddish plates, apparently triclinic, and is identical with the substance reported by Pröscher. M. T. BOGERT.

**The Reaction between Unsaturated Compounds and Organic Magnesium Compounds, V. Reactions with α-Cyancinnamic Acid.** BY E. P. KOHLER AND MARIE REIMER. *Am. Chem. J.*, 33, 333-356.—Cyancinnamic ester, although it contains two conjugated systems and two groups capable of reacting with organic magnesium compounds, reacts solely as follows: $C_6H_5CH:C(CN).COOR + R'MgBr = C_6H_5CH(R').C(CN):C(OR)OMgBr$. The phenylmagnesium bromide addition-product undergoes a very unusual reaction with acid chlorides. When it is added to an excess of the acid chloride the diphenylmethyl group is smoothly replaced by the acyl group. When the acid chloride is added to an excess of the magnesium derivative the same reaction occurs, but the diphenylmethyl chloride further reacts with another molecule of the magnesium compound. The reactions are as follows: $2(C_6H_5)_2CHC(CN):C(OMgBr)(OC_2H_5) + 2RCOCl = (RCO.C(CN):C(OC_2H_5)O)_2Mg + 2(C_6H_5)_2CHCl + MgBr_2$ and $(C_6H_5)_2CHC(CN):C(OMgBr)(OC_2H_5) + (C_6H_5)_2CHCl = (C_6H_5)_2CHC(CN):C(OC_2H_5)OCH(C_6H_5)_2 + MgBrCl$. Cinnamonitrile reacts with phenylmagnesium bromide thus: $C_6H_5CH:CHCN \rightarrow C_6H_5CH:CHC(C_6H_5):NMgBr$, while phenylcinnamonitrile does not react at all. EXPERIMENTAL—*Preparation of Ethyl α-Cyancinnamate.*—The Carrick method of preparing this substance, by condensing benzaldehyde with cyanacetic ester, was modified by working at low temperatures (—15°) and quantitative yields of the cyancinnamate were obtained. *Reaction with Phenylmagnesium Bromide.*—An ether or benzene solution was added to the boiling solution of the phenylmagnesium bromide. When the addition-product thus formed was decomposed with water the product was *ethyl α-cyan-β,β-diphenylpropionate*, $(C_6H_5)_2CH.CH(CN)COOC_2H_5$. The latter crystallizes from alcohol in large colorless pyramids, m. p. 78°. It is readily hydrolyzed by alcoholic potash; in the cold the ester group is the chief point of attack, while the boiling alkali attacks the cyanogen also. *Cyandiphenylpropionic acid* crystallizes in small colorless needles, m. p. 162°. *β,β-Diphenylpropionitrile*, $(C_6H_5)_2CHCH_2CN$, results when the cyandiphenylpropionic acid is heated above 185°. It crystallizes from low-boiling ligroin in small lustrous prisms, m. p. 100°. *β,β-Diphenylpropionamide*, from the nitrile and alcoholic potash, crystallizes in needles, m. p. 127°. *β,β-Diphenylmethylmalonamic*

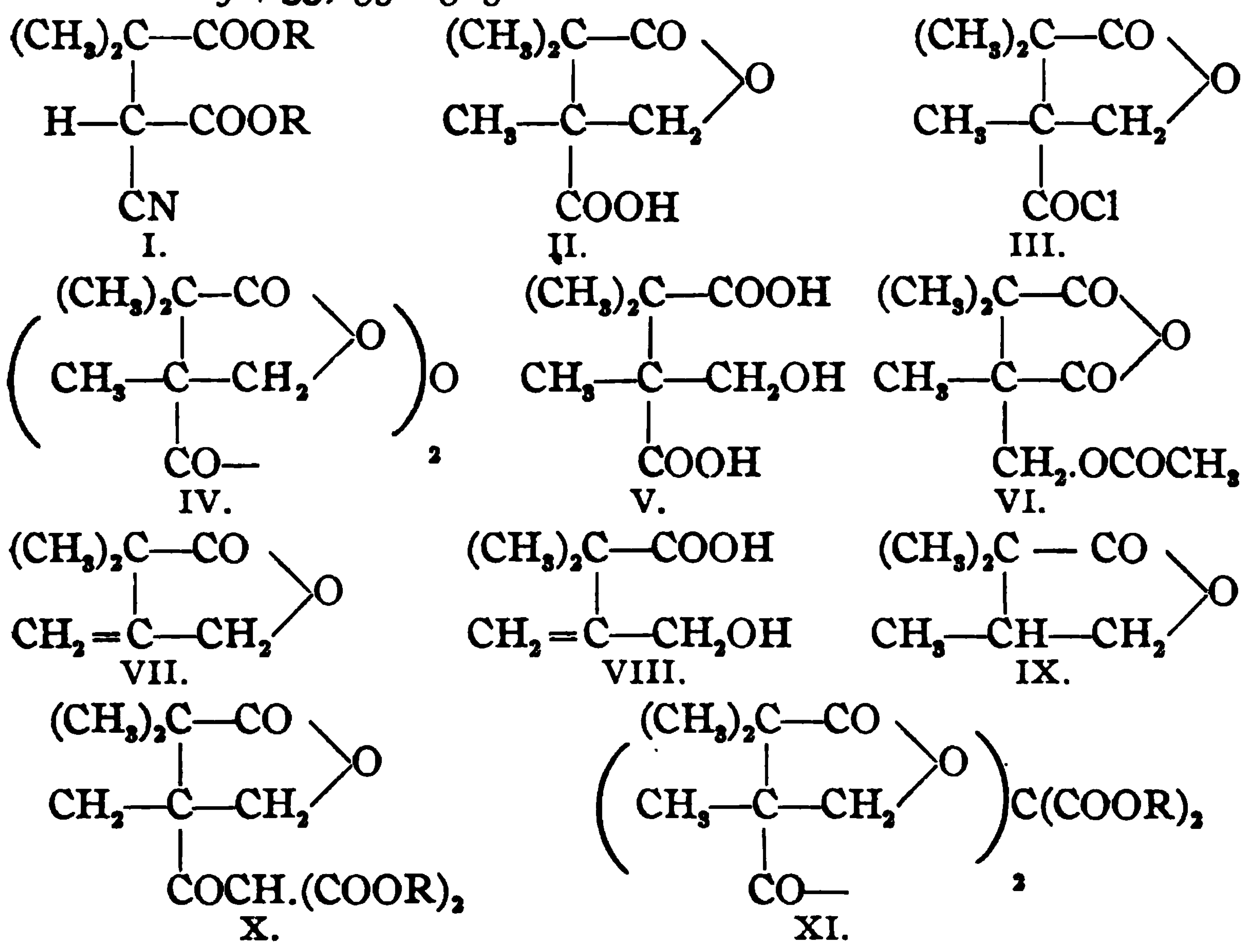
*acid*, $(C_6H_5)_2CHCH(COOH)CONH_2$, was prepared by boiling ethyl cyandiphenylpropionate with concentrated aqueous potassium hydroxide solution and then acidifying. It crystallizes from alcohol in fine needles, but loses carbon dioxide so readily that no sharp melting-point can be obtained. *Ethyl α-brom-α-cyan-β,β-diphenylpropionate*, $(C_6H_5)_2CHCBr(CN)COOC_2H_5$, obtained by the action of bromine upon the condensation product of ethyl cyancinnamate and phenylmagnesium bromide, crystallizes in large colorless prisms, m. p. 97°. Cold alcoholic potash hydrolyzes it and removes hydrobromic acid and some carbon dioxide also, giving *α-cyan-β,β-diphenylcinnamic acid*, $(C_6H_5)_2C:C(CN)COOH$, and *β,β-diphenylcinnamonitrile*, $(C_6H_5)_2C:CH.CN$. The cyandiphenylcinnamic acid crystallizes in needles, m. p. 178°, which lose carbon dioxide above 190°, or when boiled with alcoholic potash. The diphenylcinnamonitrile crystallizes from methyl alcohol in long, pale yellow needles, m. p. 49°, and is very difficult to hydrolyze. *Action of acetyl chloride on the addition-product* obtained from the cyancinnamic ester and phenylmagnesium bromide. When the acid chloride was added to an excess of the addition-product the following products were formed: $(CH_3COC(CN):C(OC_2H_5)O)_2Mg$ and $(C_6H_5)_2CHC(CN):C(OC_2H_5)OCH(C_6H_5)_2$; but only the former of these appeared when the addition-product was added to an excess of the acid chloride. $(CH_3COC(CN):C(OC_2H_5)O)_2Mg$ can be crystallized from hot, dilute alcohol in small shining prisms, containing two molecules of water, which do not lose weight below 140°, and change color above this. $(C_6H_5)_2CHC(CN):C(OC_2H_5)OCH(C_6H_5)_2$ was also prepared directly from the addition-product and diphenylbrommethane. It was crystallized from a mixture of chloroform and alcohol. It melts at 156°, does not decompose below 300° and is extremely inert. The *reaction between the magnesium compound and benzoyl chloride* gave similar results. *Ethyl magnesium cyanbenzoylacetate* crystallizes from dilute alcohol in long, silky needles containing water of crystallization. *Reaction with α-naphthylmagnesium Bromide. Ethyl α-cyan-β,β-naphthylphenylpropionate*, $(C_{10}H_7)(C_6H_5)CHCH(CN)COOC_2H_5$, from the cyancinnamate and naphthylmagnesium bromide, crystallizes from alcohol in aggregates of minute plates, m. p. 132°. *Naphthylphenylmethylmalonamic acid*, $(C_{10}H_7)(C_6H_5)CHCH(COOH)CONH_2$, obtained by boiling the above cyan ester with alcoholic potash, begins to lose carbon dioxide at 135° if heated slowly, and is oxidized to α-naphthophenone by acid permanganate. *Reaction with Methylmagnesium Iodide. Ethyl α-cyan-β-phenylbutyrate*, $CH_3(C_6H_5)CHCH(CN)COOC_2H_5$, from the cyancinnamate and methyl magnesium iodide forms an oil which will not solidify. *α-Cyan-β-phenylbutyric acid* crystallizes from chloroform in compact colorless prisms, m. p. 130°, which lose carbon dioxide at 180°. *Methylphenylmethylmalonamic acid*, $CH_3(C_6H_5)CHCH(COOH)CONH_2$, from the cyan ester and boiling

alcoholic potash, crystallizes from dilute alcohol in coarse needles, melting with decomposition at 172°. *β-Phenylbutyramide*, $CH_3CH(C_6H_5)CH_2CONH_2$, results when the foregoing is heated to 180°. It crystallizes from dilute alcohol in fine white needles, m. p. 105°. *β-Phenylbutyric acid* crystallizes from alcohol in minute plates containing water of crystallization. *Reaction with Benzylmagnesium Chloride.*—The *ethyl α-cyan-β,β-phenylbenzylpropionate* was obtained as an oil which could not be readily purified. *β,γ-Diphenylethylmalonamic acid*, $C_6H_5CH_2(C_6H_5)CHCH(COOH)CONH_2$, crystallizes from dilute alcohol in very fine needles, which lose carbon dioxide on heating, and are oxidized by acid permanganate to desoxybenzoin. *β,γ-Diphenylbutyramide*, $C_6H_5CH_2CH(C_6H_5)CH_2CONH_2$, crystallizes from dilute alcohol in long thick needles, m. p. 62°. *Reaction with Isopropylmagnesium Bromide.*—*Ethyl α-cyan-β-phenyl-γ,γ-dimethylbutyrate*, $(CH_3)_2CHCH(C_6H_5)CH(CN)COOC_2H_5$, crystallizes from dilute alcohol in fine needles, which melt with decomposition at 176°. *Reaction with phenylacetylenemagnesium bromide*; $C_6H_5C : C.CH(C_6H_5)CH(CN)COOC_2H_5$, crystallizes from alcohol in colorless needles, m. p. 80°. M. T. BOGERT.

**Action of Organomagnesium Compounds on Cinnamylideneacetophenone.** BY ELMER P. KOHLER. *Ber. chem. Ges.*, 38, 1203-1208.—The recent publication by Bauer upon the reaction between cinnamylidene-acetophenone and alkylmagnesium salts is the reason for the present paper. Bauer has apparently overlooked a previous paper by the author in which it is stated that cinnamylidene-acetophenone behaves like other unsaturated ketones with alkylmagnesium salts. No experimental details were given at the time, as a more general discussion of cinnamylidene derivatives was in mind, but in view of Bauer's paper the results are published. In all the experiments the solid ketone was added gradually to at least one and a half equivalents of the magnesium compound, as this is the simplest way to avoid the formation of complicated by-products. EXPERIMENTAL.—*β-Phenyl-β-styrylpropiophenone* (*γ-benzal-β-phenylbutyrophenone*), $C_6H_5COCH_2CH(C_6H_5)CH : CHC_6H_5$, was obtained by decomposing with ice-cold hydrochloric acid the product of the action of phenylmagnesium bromide upon cinnamylidene-acetophenone. Oxidized with permanganate it gave benzoic and α-phenyl-β-benzoylpropionic acids. *β-Phenyl-β-styrylpropiophenone oxime* crystallizes from alcohol in colorless needles, m. p. 129°. *β-Phenyl-β-styrylpropiophenone dibromide*, obtained by adding bromine to the ketone in chloroform solution, crystallizes from a mixture of chloroform and ligroin in large, glistening prisms, m. p. 171°. *β-Benzyl-β-styrylpropiophenone* (*γ-benzal-β-benzylbutyrophenone*), $C_6H_5CH : CHCH(CH_2C_6H_5)CH_2COC_6H_5$, prepared in the same way as the phenyl compound, using benzylmagnesium chloride instead of phenylmagnesium bromide, melts at 125°, and is identical with the compound which Bauer describes as "triphenylhexadienol." That it is a ketone

and not a tertiary alcohol is shown by the fact that permanganate oxidizes it to benzoic and α-benzyl-β-benzoylpropionic acids. *α-Benzyl-β-benzoylpropionic acid*, $C_6H_5COCH_2CH(CH_2C_6H_5)COOH$, crystallizes from alcohol in large, colorless needles, m. p. 176°. *β-Benzyl-β-styrylpropiophenone dibromide* crystallizes from a mixture of alcohol and chloroform in large glistening prisms, m. p. 152°. *β-Benzyl-β-styrylpropiophenone oxime* crystallizes from a mixture of ether and ligroin in needles, m. p. 144°. *β-Ethyl-β-styrylpropiophenone* (*γ-benzal-β-ethylbutyrophenone*), $C_6H_5CH : CHCH(C_2H_5)CH_2COC_6H_5$, is identical with Bauer's "diphenylmethylhexadienol." Oxidized with permanganate it gave benzoic and *α-ethyl-β-benzoylpropionic acids*. The latter crystallizes from ligroin in needles, m. p. 93°-94°. *β-Ethyl-β-styrylpropiophenone dibromide* crystallizes from a mixture of alcohol and chloroform in colorless prisms, m. p. 142°. *β-Ethyl-β-styrylpropiophenone oxime*, thin needles (from ligroin), m. p. 91°. The above results indicate that doubly unsaturated ketones behave with alkylmagnesium salts exactly like the corresponding α,β-unsaturated ketones. It has also been found that the esters of doubly unsaturated acids react similarly. M. T. Bogert.

**Camphoric Acid** (Fourteenth Paper). By William A. Noyes. *Am. Chem. J.*, 33, 356-365.—



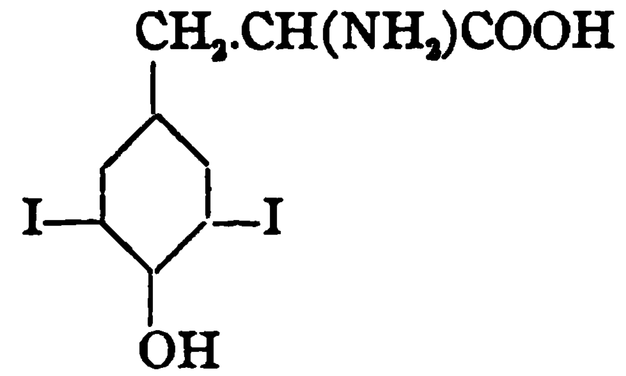
The paper describes certain derivatives of trimethylparaconic and trimethylitamalic acids. Experimental—*Preparation of Trimethylparaconic Acid.*—Ethyl bromisobutyrate and ethyl cyanacetate were condensed by sodium ethylate to ethyl dimethylcyan-

succinate (Formula I), which was then changed to the trimethylcyansuccinate and the latter saponified to trimethylsuccinic acid. Dry powdered sodium trimethylsuccinate, trioxymethylene and acetic anhydride were heated together in sealed tubes for from six to seven hours at 180°-200°. The contents of the tubes were dissolved in hot water, filtered, the filtrate concentrated and the trimethylparaconic acid (Formula II) precipitated by acidifying with hydrochloric acid. *Ethyl trimethylparaconate* is the chief product of the action of phosphorus tribromide upon ethyl trimethylitamalate. It may also be formed from trimethylparaconyl bromide and alcohol. It crystallizes in needles, m. p. 34°-35°, b. p. 150°-152° at 23 mm. *Trimethylparaconyl chloride* (Formula III), from the acid and phosphorus pentachloride, crystallizes from dry ether and melts at 139°-140°. It is decomposed but slowly by water. *Trimethylparaconyl bromide* was the only product obtained when the chloride was heated with bromine in sealed tubes. Crystallized from ether it melts at 125°. Heated with alcohol under pressure the free acid and its ethyl ester were formed. *Trimethylparaconylamide*, from the chloride and ammonia, melts at 241°-243°. *Barium trimethylitamalate* (free acid, Formula V) is formed when trimethylparaconic acid is heated with an excess of barium hydroxide solution. Boiled for half an hour with acetic anhydride it gave trimethylparaconic anhydride and acetyltrimethylitamalic anhydride. *Trimethylparaconic anhydride* (Formula IV) may also be obtained by boiling trimethylparaconic acid with acetic anhydride. It forms small granular crystals, m. p. 154°-155°. *Acetyltrimethylitamalic anhydride* (Formula VI) is an oil, b. p. 185°-195° at 20 mm. *Ethyl trimethylitamalate*, from the silver salt of the acid and ethyl iodide, was obtained as a viscous oil which could not be purified. *α,α-Dimethyl-β-methylenebutyrolactone* (Formula VII) was separated in small amount as one of the products formed when a mixture of potassium trimethylparaconate and potassium ethyl succinate was electrolyzed by the Crum Brown-Walker method. It is an oil, difficultly soluble in water and volatile with steam. The *silver salt of the corresponding hydroxy acid* (Formula VIII) crystallizes in needles. *α,α,β-Trimethylbutyrolactone* (Formula IX) was the only product isolated when ethyl trimethylparaconate was reduced with sodium and absolute alcohol. It melts at 37° and boils at 211°-212°. The silver salt of the corresponding hydroxy acid was purified and analyzed. *Ethyl trimethylparaconylmalonate* (Formula X) was prepared from sodium malonic ester and trimethylparaconyl chloride. It is an oil which boils at 250°-255° at 60 mm. *Ethyl ditrimethylparaconylmalonate* (Formula XI) was formed at the same time. It separates from alcohol in small compact crystals, m. p. 162°-163°.

M. T. BOGERT.

**Synthesis of Iodogorgoic Acid.** BY HENRY L. WHEELER AND GEORGE S. JAMIESON. *Am. Chem. J.*, 33, 365-372.—When gor-

gonin, the keratin or albuminoid composing the axial skeleton of one of the Mediterranean corals, is hydrolyzed with barium hydroxide solution it gives iodogorgoic acid. The authors have found that a diiodotyrosine, having all the properties of iodogorgoic acid, can be prepared by adding a little less than the calculated amount of iodine to a solution of *l*-tyrosine in two molecular proportions of caustic alkali at ordinary temperature. Its reactions indicate that it is a 3,5-diiodotyrosine:




EXPERIMENTAL.—*Diiodotyrosine*, $C_9H_9O_3NI_2$.—Tyrosine was dissolved in alkali and iodine added. The diiodotyrosine precipitated was recrystallized from water. The pure substance forms colorless crystals, which melt with sudden decomposition at 196°-205°. One hundred parts of water at 25° dissolve 0.2 part. It is only slightly soluble in alcohol, and is insoluble in benzene or chloroform. Strong nitric and concentrated sulphuric acids liberate iodine. Warmed with hydriodic acid it is quantitatively converted into tyrosine. Zinc and hydrochloric acid also give tyrosine. Long boiling with barium hydroxide solution only partly decomposes it. It forms sparingly soluble salts with silver, lead or copper, and is precipitated from its aqueous solutions by phosphotungstic acid or mercurous nitrate. It gives the xanthoprotein test, but not the Millon reaction. *Hydrochloride*, colorless needles, decomposed by water. *Sulphate*, colorless slender prisms. The *silver salt* is readily soluble in dilute nitric acid, while strong acid separates silver iodide, especially on warming. From solution in nitric acid it may be precipitated with ammonia and the precipitate is soluble in excess of the precipitant. *Copper salt*, pale-blue solid, crystallizes from water with one molecule of $H_2O$. *Lead salt*, white or cream-colored amorphous powder. *Monacetyl derivative*, pale-yellow powder, which effervesces at about 225°. M. T. BOGERT.

**On the Optically Active Isomers of the β-Dihydrofurfuran-α,α'-Dicarboxylic Acid.** BY H. B. HILL AND F. W. RUSSE. *Am. Chem. J.*, 33, 372-386.—It has been shown that by the reduction of furane-α,α'-dicarboxylic acid (dehydromucic acid) three isomeric dihydro acids are formed, of which the α- and β-isomers correspond to Formula I, and the γ-isomer to Formula II.


I (α- and β-acids). II (γ-acid).

The $\alpha$-acid is the inactive, the $\beta$- the racemic form. The authors have now succeeded in separating the latter into its optically active components by crystallization of its cinchonine and strychnine salts. The two optically active acids resemble each other very closely, but differ in many respects from the racemic form. Attempts to separate the $\gamma$-acid into optically active isomers were not very successful. EXPERIMENTAL—*Preparation of $\beta$-Dihydrofurfurane-$\alpha$,$\alpha'$-dicarboxylic Acid.*—Dehydromucic acid was dissolved in aqueous caustic soda, reduced with sodium amalgam, the dihydro acid formed changed to its lead salt, the latter washed with boiling water (to remove the salt of the $\alpha$-acid), suspended in water, acidified strongly with hydrochloric acid, the precipitated lead chloride filtered out and the filtrate extracted with ether. Evaporation of the ether left the pure crystalline $\beta$-acid. *Separation of the $\beta$-Dihydrofurfurane-$\alpha$,$\alpha'$-dicarboxylic Acid into its Optical Isomers.*—The cinchonine salt of the laevo acid is much less soluble in water than that of the dextro acid. By fractional crystallization of the cinchonine salts, therefore, the salt of the laevo acid was obtained pure. The mother-liquors from the first crystallization of the laevo cinchonine salt contained most of the dextro acid. This was changed to the strychnine salt, since this salt of the dextro acid is much less soluble in water than the corresponding salt of the laevo acid. By fractional crystallization of the strychnine salts then the pure dextro acid was obtained. The pure acids showed equal and opposite rotation. *Cinchonine Salts of the Dextro and Laevo $\beta$-Dihydrofurfurane-$\alpha$,$\alpha'$-dicarboxylic Acids.*—The salt of the laevo acid crystallizes from water in silky, slightly brownish white needles, less than half as soluble as the dextro salt. The salt of the dextro acid separates from water in a white, crystalline crust, apparently made up of needles. *Strychnine Salts.*—The salt of the dextro acid crystallizes in white silky needles, less soluble in water than the laevo salt. The latter also forms white silky needles. *Dextro $\beta$-Dihydrofurfurane-$\alpha$,$\alpha'$-dicarboxylic acid* crystallizes from ether in thick anhydrous prisms, from water in thick transparent white plates containing 1 $H_2O$. The anhydrous acid melts at 144°. *Laevo $\beta$-dihydrofurfurane-$\alpha$,$\alpha'$-dicarboxylic acid* resembles the dextro acid closely. Both the racemic form and its two optically active components crystallize well from water with 1 $H_2O$, and anhydrous from ether, the crystals obtained being very similar in appearance. The anhydrous racemic form melts at 178°-179° (corr.), the optically active acids at 144° (uncorr.). The latter appear to be more soluble in water or ether than the racemic form; and the same is true of their barium and lead salts. The barium salts of the three acids crystallize with 1.5 molecules of water. The lead salt of the racemic acid crystallizes with 1 $H_2O$, only half of which is given up at 195°; the lead salts of the optically active acids crystallize with two molecules of water, all of which is given up at 135°. *Specific Rotatory Power of the Dextro*

*and Laevo Acids.*—This was found to increase slightly with the dilution. For a concentration of about 10 grams in 100 cc. $[\alpha]_D =$ about 480. *Salts of the β-Acid.*—*Barium salt of dextro acid,* small white crystals, containing 1.5 $H_2O$. *Barium salt of laevo acid,* similar to salt of dextro acid. *Lead salt of dextro acid* crystallizes with 1 $H_2O$. *Lead salt of laevo acid,* similar. If saturated solutions of the dextro and laevo salts are mixed and the sides of the vessel scratched with a glass rod the racemic salt crystallizes out immediately. *γ-Dihydrofurfurane-α,α'-dicarboxylic acid* melts and almost immediately decomposes at temperatures below 195° or 190°, according to the rapidity of the heating. On boiling with water it readily takes up two molecules of water and forms a jelly. *Salts of the γ-Acid.*—*Barium salt,* white microscopic plates, containing 2.5 $H_2O$, 1 molecule of which it retains even at 190°. *Silver salt,* small white needles, containing half a molecule of water, which cannot be driven off without decomposition. *Acid potassium salt,* very fine white crystals. *Acid ammonium salt,* crystals. *Lead salt,* white and insoluble. *Attempts to separate the γ-acid into its optical isomers* failed because of the tendency of solutions of the acid or of its salts to gelatinize when heated.

M. T. BOGERT.

**Diphenylsulphone-o-Carboxylic Acid and Related Compounds.** BY WILLIAM STONE WEEDON AND HOWARD WATERS DOUGHTY. *Am. Chem. J.*, 33, 386-430.—INTRODUCTORY—By the oxidation of phenylthiosalicylic acid, $HOOCC_6H_4SC_6H_5$, with dilute nitric acid, Graebe and Schultess obtained a compound which they called "sulphobenzide-*o*-carboxylic acid," and to which they assigned the formula $HOOCC_6H_4SO_2C_6H_5$. Subsequently Canter obtained, by the oxidation of phenyl-*o*-tolyl sulphone, $CH_3C_6H_4SO_2C_6H_5$, a substance to which he assigned a similar formula. As Canter's product was entirely different from that of Graebe and Schultess, the investigation recorded in the present paper was undertaken to determine the cause of this discrepancy. The results secured may be briefly summarized as follows: When phenylthiosalicylic acid is oxidized with dilute nitric acid the product is almost wholly diphenylsulphoxide-*o*-carboxylic acid; with fuming nitric acid a substance is obtained with the same melting-point as the acid described by Graebe and Schultess, and which is a mixture of the same sulphoxide acid with its mononitro derivative; with potassium permanganate diphenylsulphone-*o*-carboxylic acid is produced. The latter acid is also obtained by oxidizing *o*-tolylphenylsulphide, or the corresponding sulphone, with permanganate. The acid melting at 267°, obtained by Canter and supposed by him to be the diphenylsulphone-*o*-carboxylic acid, is really the isomeric para compound, its formation being due to the presence of *p*-toluene sulphone chloride in the orthochloride used. Diphenylsulphide-*p*-carboxylic acid is produced from *p*-aminobenzoic acid and thiophenol, through the diazonium compound, and

on oxidation with permanganate gives the diphenylsulphone-*p*-carboxylic acid. II. OXIDATION OF PHENYLTHIOSALICYLIC ACID WITH NITRIC ACID—*Preparation of Phenylthiosalicylic Acid*, $HOOCC_6H_4SC_6H_5(o)$.—Phenylthiosalicylic acid was prepared by the action of diazotized anthranilic acid upon an alkaline solution of thiophenol. When heated gently it sublimes undecomposed; at 300° it condenses to thioxanthone. *Oxidation of phenylthiosalicylic acid by means of dilute nitric acid* gave diphenylsulphoxide-*o*-carboxylic acid. This crystallizes from dilute alcohol in long white needles, containing one molecule of water, and which have no definite melting-point. It also crystallizes anhydrous in colorless transparent rhombohedra (from strong alcohol), m. p. 163°. It is not changed by heating with concentrated or fuming nitric acid. *Barium salt*, white needles or prisms, with 8 $H_2O$. *Strontium salt*, crystals resembling the barium salt, efflorescent, and containing 8 $H_2O$. *Calcium salt*, needles or prisms, with 8 $H_2O$. *Oxidation of phenylthiosalicylic acid with fuming nitric acid* gave a product identical with that described by Graebe and Schultess, and believed by them to be the diphenylsulphone-*o*-carboxylic acid. On closer examination, however, it was found to be a mixture of diphenylsulphoxide-*o*-carboxylic acid and the mononitro derivative of the latter. The nitro acid melts at 222° (corr.), and its barium salt crystallizes in fine prisms. In presence of concentrated sulphuric acid higher nitration products were formed. III. DIPHENYLSULPHONE-*o*-CARBOXYLIC ACID—*Oxidation of phenylthiosalicylic acid by means of potassium permanganate* resulted in the formation of a substance which was not identical with the sulphone acid prepared by Canter. *Diphenylsulphone-o-carboxylic acid* was obtained by oxidizing either phenylthiosalicylic acid or diphenylsulphoxide-*o*-carboxylic acid with permanganate. It crystallizes from benzene in white needles, m. p. 143°. From aqueous solutions, by slow evaporation, beautiful clear prisms are frequently deposited, which contain one and a half molecules of water, are efflorescent, and melt at 51.5°. The acid is not decomposed below 190° and is unchanged by concentrated nitric acid. Fusion with caustic potash at 180°-210° decomposes it. Heated with concentrated sulphuric acid it yields benzophenonesulphone, while heating with lime gives diphenylsulphone. *Calcium salt*, pearly plates, with 9 $H_2O$, some of which is not driven off below 175°. *Barium salt*, needles containing water of crystallization, all of which is not lost below 175°. The *strontium salt* could not be completely dehydrated below 185°. *Benzophenonesulphone*, $C_6H_4\left\langle\begin{matrix}CO\\SO_2\end{matrix}\right\rangle C_6H_4$, was prepared by heating the diphenylsulphone-*o*-carboxylic acid with concentrated sulphuric acid and was fully identified by its properties. *Chloride of diphenylsulphone-o-carboxylic acid*, $C_6H_5SO_2C_6H_4COCl$, from the acid and phosphorus pentachloride, crys-

tallizes from ether in long, clear, colorless prisms or needles, m. p. 80° (corr.). It is very stable and is not attacked by cold, dilute alkali. *Diphenylsulphone-o-carboxylamide*, $C_6H_5SO_2C_6H_4CONH_2$, from the chloride and ammonia, crystallizes from water in slender, pure white needles, m. p. 175°-175.5° (corr.). It is very stable. Concentrated sulphuric acid changes it to benzophenonesulphone. *Diphenylsulphone-o-carboxylic anhydride*, $(C_6H_5SO_2C_6H_4CO)_2O$, from the interaction of the free acid and the acid chloride, crystallizes from benzene in small irregular colorless crystals, m. p. 146° (corr.); from alcohol, in hard crystals, m. p. 148° (corr.). It is very stable towards alkali. Concentrated sulphuric acid at 130° gradually changes it to benzophenonesulphone. *Ethyl diphenylsulphone-o-carboxylate*, $C_6H_5SO_2C_6H_4COOC_2H_5$, from the chloride and absolute alcohol, crystallizes in needles, m. p. 78°-79° (corr.). *Methyl diphenylsulphone-o-carboxylate* crystallizes in rectangular plates (from methyl alcohol), m. p. 63°. *Molecular Weight of Diphenylsulphone-o-carboxylic Acid.*—Determinations of the molecular weight in benzene and alcohol by the ebullioscopic method gave results closely approaching the theoretical. *o-Benzoyldiphenylsulphone*, $C_6H_5SO_2C_6H_4COC_6H_5$, was obtained by treating the above acid chloride with benzene and aluminum chloride. Fused with caustic potash at 210°, it is decomposed into benzoic acid and diphenylsulphone. IV. OXIDATION OF *o*-TOLYLPHENYLSULPHIDE—*o-Tolylphenylsulphide*, $C_6H_5SC_6H_4CH_3$, was prepared from diazotized *o*-toluidine and thiophenol. *Oxidation of o-Tolylphenylsulphide* with permanganate gave diphenylsulphone-*o*-carboxylic acid. V. "*o*-PHENYLSULPHONEBENZOIC ACID" OF CANTER—The *o*-toluenesulphone chloride used was from the same lot that Canter used. With benzene and aluminum chloride it gave a tolylphenylsulphone identical with that described by Canter. *Preparation of "o-Phenylsulphonebenzoic Acid."*—Canter's method was followed and the acid described by him (m. p. 267°) obtained. The yield was very small, and in the mother-liquors from the crystallization of the acid a large amount of diphenylsulphone-*o*-carboxylic acid was discovered. A molecular weight determination of Canter's acid showed it to be isomeric with diphenylsulphone-*o*-carboxylic acid. *Purification of o-Tolylphenylsulphone.*—By repeated fractional crystallization of the crude *o*-tolylphenylsulphone the pure ortho compound was obtained in colorless rhombic plates, m. p. 81° (corr.), which, oxidized with permanganate, gave only diphenylsulphone-*o*-carboxylic acid. The presence of *p*-toluenesulphone chloride was demonstrated in the crude orthochloride used by Canter, and it is probable, therefore, that his acid was the diphenylsulphone-*p*-carboxylic acid. VI. DIPHENYLSULPHONE-*p*-CARBOXYLIC ACID—*Diphenylsulphide-p-carboxylic acid* was prepared by the action of diazotized *p*-aminobenzoic acid upon thiophenol. It crystallizes from ligroin in light, colorless, feathery, elongated hexagonal plates, m. p. 177° (corr.). Its *barium salt*

crystallizes from water in very thin plates, containing two and a half molecules of water. *Oxidation of Diphenylsulphide-p-carboxylic Acid by means of Potassium Permanganate.*—This gave diphenylsulphone-*p*-carboxylic acid, which crystallizes from alcohol in small leaflets, m. p. 267° (uncorr.), 277° (corr.), and is identical with the acid described by Canter as the ortho isomer. The *barium salt* crystallizes in slender white needles, containing three molecules of water, the *calcium salt* in fine white needles with 6 $H_2O$. In both salts the water is not completely removed below 165°. *p-Phenylsulphonebenzoic chloride*, $C_6H_5SO_2C_6H_4COCl$, from the acid and phosphorus pentachloride, crystallizes from ligroin in small colorless square plates, m. p. 146°-147° (corr.). *p-Phenylsulphonebenzamide*, from the acid chloride and ammonia, crystallizes from water in feathery white crystals, m. p. 248.3°-248.8° (corr.). M. T. BOGERT.

**Notes on Organic Analysis, Part III.** BY HENRY C. SHERMAN. *School of Mines Quart.*, **26**, 201-266 (see this Journal, 27, R 150 and 268).—The following chapters are given: VII. Carbohydrates—Special Methods (concluded); VIII. Acids; IX. Oils, Fats and Waxes—General Methods; X. Fatty Oils—Special Methods. M. T. BOGERT.

## BIOLOGICAL CHEMISTRY.

**Pharmacology of Ethyl Salicylate.** BY E. M. HOUGHTON, *Am. J. Physiol.*, 13, 331-341.—Ethyl salicylate is a transparent, colorless, volatile, slightly soluble, oily fluid possessing a pleasant characteristic odor and taste. Culture experiments show it has no antiseptic action. As a result of application to skin or mucous membranes there is little or no irritation. The minimum fatal dose per gram for guinea pigs is 0.0015 gram internally and 0.0014 gram subcutaneously. Large doses given internally for several days in succession produce slight symptoms of gastric irritation, sufficient to produce vomiting, loss of appetite, and finally death from irritation. Ethyl salicylate is not absorbed from the respiratory tract, or when applied to the skin, but it is quickly absorbed from the stomach, or when given subcutaneously, and is rapidly excreted through the kidneys. The general action of the drug is as follows: There is a gradual rise in temperature after the administration of a single dose internally. The temperature then falls less quickly to normal. The pulse rate is slowed at first, probably from vagus stimulation, later is accelerated on account of the general excitement of the animal. Respiration during the first hour is slowed, but becomes rapid as the drug is absorbed, probably from stimulation of the respiratory centre. Blood-pressure, myocardiographic

and respiratory experiments upon anaesthetized animals show that ethyl salicylate stimulates centres in the medulla, producing, if the dose be large, increased frequency of respiration, lowering of blood-pressure, and a tendency for the heart to assume a diastolic condition. If the drug is pushed, the animal dies of paralysis of the respiratory centre, or in case artifical respiration is supplied, the toxic action upon the heart is sufficient to produce diastolic standstill, for the most part due to the direct action of the drug upon the muscle itself. In all cases the results obtained with ethyl salicylate were compared with those of the methyl compound, the latter being found much more toxic (minimum fatal dose 0.0007 per gram body-weight). It also produces more irritation of the alimentary canal, and is decidedly more irritating, evidenced by the appearance of the alimentary canal, when injected subcutaneously, etc.

F. P. UNDERHILL.

**The Chemistry of Malignant Growths, III. Nucleo-histone as a Constituent of Tumors.** BY S. P. BEEBE. *Am. J. Physiol.*, 13, 341-350.—Tumors do not contain any appreciable quantity of nucleo-histone. F. P. UNDERHILL.

**Recent Advances in Our Knowledge of the Chemical Processes of Digestion.** BY LAFAYETTE B. MENDEL. *Med. News*, 86, 913-918.—A review of the literature on recent advances in the chemistry of digestion. F. P. UNDERHILL.

**The Influence of Cobra Venom on the Proteid Metabolism.** BY JAMES SCOTT. *N. Y. and Phila. Med. J.*, 81, 937-941.—Practically no change in the rate of proteid metabolism was induced by the administration of cobra venom in spite of well-marked local reaction. A slight decrease in the proportion of urea nitrogen, quite insignificant compared with that produced by diphtheria toxin and various drugs, was observed. A slight rise in the ammonia nitrogen occurred and also a slight rise in the proportion of nitrogen to purin bodies. The nitrogen in other compounds showed no constant change. The phosphates excreted showed no constant change, but in two experiments there was a slight rise. F. P. UNDERHILL.

**Alcohol as Food.** BY RUSSELL H. CHITTENDEN. *Med. News*, 86, 721-724.—While alcohol in moderate amounts can be burned in the body, thus serving as food in the sense that it may be a source of energy, it is quite misleading to attempt a classification or even comparison of alcohol with carbohydrates and fats, since, unlike the latter, alcohol has a most disturbing effect upon the metabolism or oxidation of the purin compounds of our daily food, in that it is at all times liable to obstruct the oxidation processes of the liver and other tissues, thereby throwing into the circulation bodies, such as uric acid, which are inimical to health.

F. P. UNDERHILL.

**Variations in Virulence in Organisms Acted upon by Serum, and the Occurrence of Spontaneous Agglutination.** By Edna Steinhart. *J. Med. Research*, 13 (New Series 8), 409-419.—The effect on the virulence of the maltose-fermenting paradysentery bacillus (Flexner) after growth in inactive horse sera—immune and normal—was non-uniform. In four series of passages of typhoid bacilli through bactericidal horse serum, uniform results were not obtained. Spontaneous agglutination occurred after the twentieth passage in the series passed forty-three times through bactericidal serum.

F. P. Underhill.

**Changes in the Bacterial Content of Water in Passing through a Distributing Reservoir.** By B. G. Philbrick. *J. Med. Research*, 13 (New Series 8), 419-423.—The total effect of the passage of water through a reservoir is to diminish the number of bacteria in the effluent water relative to the influent, but the relative positions of the two figures vary greatly from month to month and from year to year.

F. P. Underhill.

**Studies on the Bactericidal Action of Copper on Organisms in Water.** By Nathaniel Gildersleeve. *Am. J. Med. Sci.*, 129, 754-760.—Dilute solutions of copper salts have a marked destructive action on many bacteria. Of these salts the sulphate is the most active. This is probably due to the fact that it undergoes electrolytic dissociation more readily than the others. The amount of sulphate to be used in the water should be from one part in 250,000 to one part in 100,000, depending on the character of the water. Colloidal copper will quickly destroy certain bacteria; should copper vessels or plates be used to destroy bacteria in water, they must be kept highly polished or the bactericidal properties will be greatly reduced. The ingestion of copper for long periods seems to give no evidence of a detrimental action on the health of an individual.

F. P. Underhill.

**A Second Coagulation of the Blood Due to a Substance that Is Not Identical with Fibrinogen and Is Coagulable with Neutral Oxalate.** By Edward T. Reichert. *J. Expt. Med.*, 7, 173-176.—Reichert shows that there is contained in the blood of certain animals a substance not identical with fibrinogen which causes the blood to coagulate. This unknown body is in some way intimately connected with the red cells.

F. P. Underhill.

**A Study of the Changes in the Blood and Blood-forming Organs Produced by Cytotoxic Sera, with Special Reference to Haemolymphotoxin.** By Harro Woltmann. *J. Expt. Med.*, 7, 119-163.—The cytotoxins are not specific. The changes oc-

curring after the injection of different cytotoxins are similar and do not vary in kind. The changes do, however, vary in degree in the following order, the one having the most marked effect being placed first, etc.: haemolymphotoxin, splenotoxin, lymphotoxin, endotheliotoxin, nephrotoxin, hepatotoxin. Nephrotoxin causes the most specific change. The haemolymph glands play some important part in the production of eosinophiles. The haemolytic action of haemolymphotoxic serum is greater than that of other cytotoxic sera. The histological changes which are observed in every case are secondary to the haemolytic factor present in all cytotoxic sera. F. P. UNDERHILL.

**A Study of the Protective Action of Snake Venom upon Blood Corpuscles.** BY HIDEYO NOGUCHI. *J. Expt. Med.*, 7, 191-223.—Washed blood corpuscles of certain species of animals in a concentration of about 5 per cent. suspended in salt solution containing above 4 per cent. of cobra venom undergo changes in their resistance to certain physical and chemical agents. They become non-haemolyzable by water, ether, saponin and quite strong solutions of lecithin, provided always that the excess of venom has not been entirely removed. On the other hand, certain acids and alkalies, excepting ammonia, lake the venomized corpuscles more easily than they lake normal corpuscles. Venom solutions of 2 per cent. and less exert no protective property upon blood corpuscles, but they induce changes in the corpuscles whereby they are rendered more easily laked by the same physical and chemical agents. The changes in the corpuscles upon which this protection depends can be set aside by repeated washings of the venomized corpuscles in 0.9 per cent. salt solution. The substance in venom upon which the protective action relies is not destroyed by the temperature of 95° C., although at this temperature a part of the venom is coagulated. The protective body is found in the coagulated portion, while the venom haemolysin is contained in full activity in the clear filtrate. The agglutinin for red corpuscles disappears at 75° C., hence the protector of corpuscles by venom depends neither upon the haemolysin nor the agglutinin. Blood corpuscles absorb the haemolysin from concentrated solutions of venom as readily as from weaker solutions. Corpuscles which have been protected and again rendered haemolyzable are less resistant to injurious influences than normal corpuscles, resembling in this respect corpuscles which have been treated with relatively weaker solutions of venom. Venom, therefore, always exerts a direct injurious influence upon blood corpuscles but strong solutions of venom may obscure this injurious effect through the predominance of the protective action which they display. Not all blood corpuscles are susceptible to the protective action of venom, nor do all venoms possess the protective power in degree equal to cobra venom. F. P. UNDERHILL.

**Casein and Paracasein in Some of their Relations to Bases and Acids.** BY LUCIUS L. VAN SLYKE AND EDWIN B. HART. *Am. Chem. J.*, May, 1905.—The authors have made preparations of the following compounds: casein, the base-free or uncombined proteid; basic calcium casein, containing the free proteid combined with about 2.40 per cent. of calcium oxide; neutral calcium casein, the free proteid combined with 1.5 per cent. of calcium oxide, probably identical with casein as it exists in cows' milk; casein salts of acids, formed by the combination of the free proteid with acids; paracasein, the base-free or uncombined proteid; basic calcium paracasein; neutral calcium paracasein; paracasein salts of acids. Rennet enzymes coagulate neither neutral, nor basic calcium casein. Neutral calcium casein, after treatment with rennet, is coagulated at ordinary temperatures by soluble calcium salts. Soluble calcium salts coagulate both neutral and basic calcium casein on warming to 35°-45° C. When an acid is added to cows' milk or formed in it, the acid first combines with the bases of some of the inorganic salts of the milk and then with the calcium that is combined with the casein, resulting in the formation of a precipitate which is free casein. By further formation or addition of acid, the free casein unites with it, forming a casein salt of the acid, this compound, in the case of lactic acid, being the coagulum familiar in the ordinary souring of milk. The coagulum following the addition of rennet to milk is calcium paracasein, either mixed or loosely combined with soluble calcium salts. While lactic acid is being formed in the process of cheese-making, it combines with the calcium of the calcium paracasein, forming free paracasein and calcium lactate. It is this free paracasein, thus formed, that is soluble in warm dilute salt solution and in hot 50 per cent. alcohol and possesses characteristic properties of plasticity and ductility. In view of the fact that much confusion at present prevails in the use of the terms casein and paracasein, it is suggested that the following nomenclature be used: (1) That the compound existing in cows' milk be called calcium casein; (2) that only the free proteid be called casein; (3) that the casein compound containing 2.4 per cent. calcium oxide be called basic calcium casein; (4) that a compound formed by precipitation and combination with acid be called a casein salt of the acid used; (5) that the same nomenclature be applied to the corresponding paracasein bodies, with the following addition: Calcium paracasein should be applied to the uncoagulated form and the term coagulated calcium paracasein to the coagulated form. F. P. UNDERHILL.

## PHARMACEUTICAL CHEMISTRY.

**The Cultivation of Saffron in Lebanon County, Pennsylvania.** BY J. L. LEMBERGER. *Am. J. Pharm.*, 77, 209.—The bulbs are

planted in the spring, in rows 6 inches apart and 5 to 8 inches deep. The plant sends forth shoots late in September or early in October when both leaves and flowers appear at about the same time. The time of gathering the flowers extends over eight to ten days. An area of 12x14 feet (1/259 acre) produced 1500 to 2000 flowers per season valued at $9 to $10.

W. H. BLOME.

**Ointment of Mercuric Nitrate.** BY C. O. SNAVELY. *Am. J. Pharm.*, 77, 233.—The following formula and method of preparation of this ointment are suggested:

| | Grams. |
|---|---|
| Red mercuric oxide | 75.5 |
| Nitric acid | 175.0 |
| Lard oil | 760.0 |

Heat the oil to 100°, then add gradually 100 grams of nitric acid, heat until effervescence ceases and finally cool to 40°. To this add the solution of mercuric nitrate made by the reaction of the remainder of the nitric acid upon the mercuric oxide. Heat the mixture to 60° until all evolution of gas ceases. Cool and mix thoroughly.

The advantages of this formula over the official one are, a definite solution of mercuric nitrate without any mercurous salt, more nitric acid to oxidize the fat, and a product having less odor.

W. H. BLOME.

**Note on Slaked Lime and Bleaching Powder.** BY L. REUTER. *Pharm. Rev.*, 23, 125.—Tables and figures showing the amounts of materials used to furnish certain quantities of finished product together with cost of labor and of finished product.

W. H. BLOME.

**Drugs of North America.** BY EDWARD KREMERS. *Pharm. Rev.*, 23, 130.—A list of twenty-one crude drugs which were in use by the Indians of this continent. Several of the drugs mentioned are in favor with physicians at the present time.

W. H. BLOME.

## SANITARY CHEMISTRY.

**A Study of the Action of Colloidal Solutions of Copper upon Bacillus Typhosus.** BY A. H. STEWART. *Am. J. Med. Sci.*, 129, 760-769.—There is a natural tendency for typhoid bacilli to die when the water containing them is allowed to stand for a long period. Sterile drinking-water in clean copper vessels inoculated with typhoid bacilli invariably showed that the bacilli had all perished in one hour. Water similarly treated in tin vessels invariably showed living organisms at the end of twenty-four hours. Water similarly treated in glass vessels exposed to light

showed varying results, but in no instance had the typhoid organisms all perished in three hours. Water similarly treated in enamel vessels showed a slight diminution of the number of typhoid organisms in three hours. Water similarly treated in aluminium vessels showed a disappearance of the typhoid organisms in three hours. Raw tap-water in glass vessels showed a increase in the number of organisms in three hours. Raw tap-water in copper vessels in one experiment showed a diminution from 384,000 germs per cubic centimeter to 18,000 per cubic centimeter in three hours. Raw tap-water containing large numbers of river organisms and considerable vegetable matter, when inoculated with millions of typhoid organisms and placed in a copper vessel, showed that the typhoid bacilli were killed in one and three-fourths to two and one-half hours. Water containing colloidal copper has a more rapid toxic effect upon typhoid than upon river-water organisms. The quantity of colloidal copper given off from a one liter copper vessel in three hours was one part in four million. This amount killed off the added typhoid organisms in from one and three-fourths hours to two and one-half hours, and chemical experience has shown that this amount of colloidal copper is harmless when taken into the human system. In epidemics of typhoid fever, water could be purified of typhoid organisms by allowing it to stand in a copper vessel for three hours. F. P. UNDERHILL.

**The Action of Electrically Charged Copper upon Certain Organisms in Water.** BY MARY ENGLE PENNINGTON. *Am. J. Med. Sci.*, 129, 751-754.—Copper electrodes carrying a small current are actively germicidal for *B. typhosus* and *B. coli communis*. The former is the more easily affected. That it is the copper which plays the important rôle is shown by substituting for it platinum electrodes. F. P. UNDERHILL.

## INDUSTRIAL CHEMISTRY.

**The Chemistry of Flame.** BY CHAS. S. PALMER. *Eng. and Min. J.*, April 20, 1905.—It is pointed out that there is a complete analogy between flames and solutions, with regard to their ionization and consequent electrical conductivity. The non-luminous portions have a greater ionizing effect than the luminous. S. P. SADTLER.

**Carbon Tetrachloride and its Use as a Solvent for Differentiating Bitumens.** BY CLIFFORD RICHARDSON AND C. N. FORREST. *J. Soc. Chem. Ind.*, April 15, 1905.—This paper deals mainly with the physical properties of carbon tetrachloride as a solvent, though it also refers to a selective action of the solvent on hydrocarbons of many residuums, tars, overburned asphalt and over-

burned oil residuums, while it dissolves natural asphalt completely.

Some of the properties of carbon tetrachloride are: Non-inflammability, sp. gr. 1.604, low vapor-tension and high specific heat (easily condensable), index of refraction 1.464, boiling-point 76.6° C., non-toxic.

It is a very good solvent for general purposes.

It is not inflammable, and when mixed with petroleum naphtha, benzene, turpentine, etc., in proportions varying about 50 per cent., it prevents ignition of these substances.

S. P. Sadtler.

**Boiler Waters and Their Treatment.** By Wm. M. Booth. *Chem. Engineer*, March, 1905.—Water contains more or less dirt in suspension. A settling tank will allow this to deposit and also remove much of the carbon dioxide, hydrogen sulphide, iron oxide and decayed matter. Waters containing more than 1000 mg. per liter or 58 grains per gallon of either suspended or dissolved solids should be treated.

Where the surface rock is of granite or quartz formation, waters are relatively soft, but where limestone and magnesium rocks are in the overlying strata, water becomes hard. This condition is most prevalent.

The salts usually found in water are those of calcium, magnesium, sodium and iron. The very soluble salts are not termed scale-forming.

The limit of softening by boiling of waters containing calcium and magnesium carbonates is about 2 grains to the U. S. gallon.

Sulphate of lime is soluble in distilled water to the extent of about 133 grains per U. S. gallon, and, according to authorities referred to by the author, becomes less soluble to a temperature of 150° C. Scale formed by sulphate of lime is very hard and difficult to remove.

Calcium and magnesium chlorides decompose on the shell and tubes and form hard crusts.

As a mechanical means of preventing scale and easily blowing off impurities, various substances, such as fibers of jute, charcoal, coal dust, or other inert matters, capable of forming nuclei about which particles of calcium and magnesium carbonates agglutinate and remain in a non-coherent condition, may be used.

S. P. Sadtler.

**Report of the U. S. Naval Liquid Fuel Board of the Relative Evaporation Efficiencies of Coal and Liquid Fuel.**—This exhaustive treatise of considerably over 400 pages takes up all branches of the subject. Using the same boilers, coal was burned in series of tests and then oil. In the latter case many forms of burners, representing practically all styles, were used. All governing conditions such as production, transportation, storing

and installations for using are dealt with in a most complete and satisfactory manner

A digest of the conclusions is given as follows:

(1) That no difficulty should be experienced by skilled firemen in burning oil in a uniform manner.

(2) High pressure steam is better for spraying than air on shore. Some objection due to size of evaporating plant is made to its use on board vessels.

(3) Highly heated compressed air is best for forced draught.

(4) Tanks must be fitted to trap off water, so as not to allow the same to enter burners.

(5) The evaporation efficiencies of crude and refined oil are nearly the same, but the danger with crude oil is much greater.

(6) Benefit of preheating air for combustion.

(7) To supply oil uniformly it is best to heat it.

(8) Increasing the number of burners promotes uniformity; it is also best to have reserve burners.

(9) The hygrometric state of the atmosphere has an effect on the capacity of the boilers.

(10) There should be an air cushion in the oil pump to make the feeding uniform.

(11) Oil should be strained at entrance and exit of oil supply tanks.

(12) Furnaces should be simple.

(13) Furnaces should all be fitted for grate and bearing bars so that use of coal could be quickly resorted to.

(14) In Scotch boilers retarders should be used in the tubes.

(17) Installation should only be entrusted to experienced hands.

(18) Petroleum that has undergone slight refining is not corrosive to modern steel boilers, but crude oil is.

(19) Oil compartments on board vessels should be few.

(20) Forcing marine boilers is easier with oil than with coal.

(21) Burning oil with forced draft conditions in water-tube boilers is productive of much smoke. With limited amounts in Scotch boilers with retarders it should be smokeless.

(22) The value of a series of draft gauges between ash-pan and the base of the stack was shown.

(25) All so-called refractory bricks disintegrated when used as deflecting arches. Experiments to secure suitable brick should be undertaken.

(26) Fuel oil should not flash under 175° F.

(27) Oil should not be used in an auxiliary capacity to coal.

(28) Oil should not be carried directly below the boilers.

(30) A commission should be appointed by Congress to regulate oil-fuel installations as a safeguard to protecting the supply.

(31) The board regards the engineering feature of the liquid-fuel problem as having been satisfactorily solved.

(32) Oil fuel, due to the available supply, should only be used for special purposes.

The board calls attention to the number of officers and force engaged on this work for twenty-eight months, use having been made of the entire crew of the torpedo boat "Rogers."

S. P. SADTLER.

**Description of a Fire, Load and Water Test.** BY IRA H. WOOLSON. *School of Mines Quart.*, November, 1904.—Specifications accompanied by sketches for test house are given. These are the same as those of the New York City Building Bureau.

Results of heat generated below a floor to be tested, and that of the application of water under 60 pounds' pressure applied to the red-hot surfaces are given with measurements of deflections.

S. P. SADTLER.

**New Form of Electrode for Lead Storage Cells.** BY H. M. DADOMIAN. *Am. J. Sci.*, April, 1905.—The electrodes are made out of rolled, perforated sheet-lead filled with a paste of litharge and sulphuric acid. These electrodes are placed in a wide-mouthed bottle with a glass tube sealed in the stopper for the outlet of the gases.

It is claimed to be of very constant potential and to have no noticeable drop in voltage for months. S. P. SADTLER.

**The Lomax Improved Method of Purifying "Peculiar" Illuminating Gas.** *Am. Gas Light J.*, February 27, 1905.—The article is based on specifications and claims of U. S. Patent 782,403.

The process is said to consist in reacting with amines upon carbon disulphide in the presence of finely divided sulphur as a catalytic agent. The latter, being absorbed and held by bog iron ore, Weldon mud, Lux's mass, Laming's mass, spent lime, etc. Aniline is the amine used, which is added to the finely divided sulphur. S. P. SADTLER.

**The Dry Mixture of Cement.** *Am. Gas Light J.*, February 13, 1905. G. A. L. GOETZMANN.—The paper treats of cement mainly from the standpoint of block manufacturers.

*Sampling.*—A pound should be taken from every tenth barrel, kept separately and divided into two portions, the first for a water test, and the second for a tensile strength test.

*Water Test.*—A sample is placed in a cup or saucer and water added drop by drop. If it absorbs water freely, it is Portland cement. If only to a small extent and it is dark in color, it is a very low-grade Portland cement; but if light in color it is a puzzolani cement made from furnace slag and unfit for stone purposes. Similar crude tests are given. S. P. SADTLER.

**Method for Testing Asphalt.** From report of Inspector of

Asphalts and Cements, District of Columbia, A. W. Dow; Inspector, *Chem. Engineer*, March, 1905.—The author refers to the generally received practical definition of a bitumen as any organic compound (whether of natural or artificial origin) which is soluble in carbon disulphide. It is doubted, however, whether the bitmens are true solutions in each other. Bermudez asphalt, on being kept molten, will slowly separate, a thick gummy mass going to the bottom.

Suitability for practical use is determined by actual trial or by comparison with accepted grades. The latter method is the one, however, which must necessarily be resorted to. The physical and chemical properties of the composition in question are compared with those of known value.

Only when an asphaltic cement contains over 96 per cent. of bitumen, is it pure enough to test. That requiring purification is extracted with carbon disulphide, directions being given for extraction and removal of traces of solvent.

TESTS.—(1) Consistency at 32°, 77° and 115° F. is determined by the distance a No. 2 needle held by a penetration machine will go with weights as follows: 32°, 200 grams for one minute; 77°, 100 grams for five seconds; 115°, 50 grams for five seconds; measurements in hundredth centimeters.

(2) Ductility at 77° F. is determined by measuring the distance in centimeters that a briquette of the material can be drawn before breaking. The bitumen to be tested must first be brought to a consistency of 50 "penetrations," by softening with a flux, such as is to be used in the practical work.

(3) *Heat Test.*—Fifty grams of the sample are weighed in a tin box with vertical sides 2 cm. deep, and 6 cm. in diameter. The sample is tested for penetration before and after heating at 300° F. for eighteen hours. A figure called per cent. of hardening is obtained in this way.

(4) *Water Test.*—A piece of glass coated with the asphaltic cement is immersed in distilled water at a temperature between 70° F. and 90° F. for seven days. It should show no discoloration or corrosion. S. P. SADTLER.

**The Chemistry of Wool.** BY J. MERRITT MATTHEWS. *J. Frank. Inst.*, May, 1905.—The author refers in the first place to the composition of the fleece and then to the wool proper.

There is the oil or wool fat to the extent of from 8 to 12 per cent. The suint, or dried perspiration, to the extent of from 15 to 20 per cent. The wool hairs themselves and varying amounts of dirt.

The percentages vary with the breed of sheep, the climate and care given them.

Wool fiber belongs to a class of proteid substances very closely related to skin tissues, feathers, hair, horn and leather.

It is not soluble in water except under pressure.

It seems to be an amino acid as ammonia is obtained on

the destructive distillation of wool; further confirmation of the presence of the amino group is obtained by the fact that diazo dyes can be made from wool itself. It is also able to neutralize a considerable and definite amount of acid, having a so-called acid figure thus, wool 57 (milligrams per gram of wool) compared with silk 143, albumen 20.0, gelatin 28.4.

It also combines with some acid dyestuffs.

On the other hand, it has weak acid properties, as it partly neutralizes alkalies and, furthermore, has less attraction for some basic dyestuffs after saturation with alkali.

S. P. SADTLER.

**Standards of Purity for Fermented and Distilled Liquors.** BY PHILIP SCHIDROWITZ. *J. Soc. Chem. Ind.*, February 28, 1905.—The two factors discussed by the author are adulteration proper and misdescription. With reference to setting arbitrary standards, the author calls attention to a test case on brandy in which, according to the law in England, brandies should contain 80 grams of compound ethers for every 100 liters of absolute alcohol. This is nothing more than a premium upon adulteration, as the addition of compound ethers to spirits enables them to come within such specifications and really provides an inferior product; and also natural liquors vary so much that a single analytical figure leads to unfair condemnation in certain cases.

The author thinks that in wines the limit of 20 mg. of free sulphurous acid is too low, as in the case of Chateau Yquem frequent rackings are necessary, and a limit of 400 mg. of total sulphurous acid and 30 to 40 mg. of free acid would not be excessive. Such heavy wines are only consumed in small quantities, the French government having adopted a standard of 440 mg. as their limit, and in regard to the per cent. of alcohol all figures above 14 per cent. should not be definitely considered as fortified, as the author has found wines which he has reason to believe were perfectly natural, containing 15 per cent. and more.

To fully arrive at the genuineness of a wine, it is necessary to make a complete analysis and to compare all figures with published data and in addition to this to consider whether there are any special circumstances affecting the case in point, and that an expert taster should be called in when in doubt.

The author does not agree with Dr. Wiley that the object of storage of brandy in wood is the elimination of fusel oil.

In the author's opinion, the analysis of brandy, as generally carried out in France and England, is useful only in a negative sense, that is, if the figures as a whole fall below the limits indicated by experiences as being normal for a genuine spirit it may be recorded as presumptive evidence that the spirit is not genuine. It is not considered that with whiskey the limit of 0.25 per cent. of fusel oil will inconvenience the whiskey distiller, but he suggests the use of 0.3 per cent. as a safer limit, especially as the determina-

tions of fusel oil are not very exact and are open to some variation.

With regard to coloring with caramel, the author does not look upon the addition of moderate amounts to vary the color as objectionable when this is done to maintain certain standards, but the entire addition of caramel to make silent spirits simulate whiskey is not regarded as allowable.

The writer does not believe in labeling packages with a detailed statement as to their contents, and he thinks it would be necessary to make an expert chemist of every man, woman and child, otherwise such labeling would merely lead to confusion, but that as an element of safety every article of food or drink, either imported or manufactured at home, should, when placed upon the market, be submitted, together with a statement as to the origin, constituent parts, manufacture, etc., to a Board of Reference composed of expert hygienists, chemists and representatives of various industries.

S. P. SADTLER.

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## AGRICULTURAL CHEMISTRY.

**Detection of Adulteration in Maple Sugar and Sirup.** BY C. H. JONES. *17th Annual Report of the Vt. Agr. Expt. Sta.*, 1903-1904.—The article gives the methods employed by the author in the examination of maple products and discusses the interpretation of results obtained by those methods. It is suggested that 0.5 per cent. is the minimum figure of ash in maple syrup, and 0.6 per cent. in maple sugar. Owing to the fact that the filtration methods employed by maple sugar factories are not altogether thorough, these minimum figures are rarely attained.

It is suggested that in determining the ash, maple goods char much more readily than white and brown sugar, and that in the former there is no difficulty in burning directly "to a white or gray ash which is usually of a leafy, network structure. Again the water-soluble ash solution of the latter may exhibit, even after filtration, a pronounced cloudiness not cleared by the addition of hydrochloric acid. This has never been noticed when analyzing brown sugar or maple goods heavily adulterated with white sugar."

Attention is called to the fact that calcium malate is usually removed more completely from maple syrup than from maple sugar, owing to the fact that the turbidity caused by it in the former is objectionable. Analyses are given of pure maple sugar, pure maple syrup and maple sugar and syrup adulterated with sucrose, and standards of composition are suggested.

Aside from the other determinations described it is suggested that 20 grams of the material be dissolved in a 4-ounce beaker in from 20 to 40 cc. of water, and the solution boiled until it reaches the temperature of 250° F. The odor of the mixture, while still boiling or immediately after removal from the heat, is found to be

of value in connection with other data in judging the purity of the product. W. D. BIGELOW.

**Inspection and Control of Food Products in New Hampshire.** BY H. E. BARNARD. *Report of the New Hampshire State Board of Health for the two years ending November* 1, 1904.—The report includes a description of the methods employed by the Board of Health in enforcing the food law of the state, and reports in detail the results of the examination of samples collected. "Of the 1,292 articles examined 513 were adulterated or varied from the legal standard. This is equivalent to an adulteration of 39.77 per cent. It must be remembered, however, that in collecting samples for analysis care was taken to collect articles of a suspicious character. Therefore, the extent of adulteration of all food products is not shown by this figure, and is represented by a much smaller percentage."

In addition to the classes of foods enumerated below, the following articles were inspected: Butter, canned fruits, jellies and jams, canned goods, coffee, chocolate and cocoa, cream of tartar and baking-powders, honey, maple syrup, olive oil, condensed milk, and a number of miscellaneous products. None of the samples of condensed milk examined were below standard. In each case of foods those samples that were decided to be adulterated or below standard are given in tabular form. The following tabular statement gives the number of samples examined and the number adulterated or below standard in several of the classes of foods examined.

| Article. | No. of samples examined. | No. of samples adulterated or below standard. |
|---|---|---|
| Fruit syrups | 36 | 23 |
| Lemon extracts | 53 | 34 |
| Milk and cream | 371 | 111 |
| Molasses | 51 | 16 |
| Oysters | 123 | 50 |
| Sausage | 13 | 12 |
| Spices | 45 | 5 |
| Tomato ketchups | 36 | 31 |
| Vanilla extract | 32 | 21 |
| Vinegar | 68 | 39 |

W. D. BIGELOW.

**Food Inspection.** BY JAS. H. SHEPARD. *Fourth Annual Report of the South Dakota Food and Dairy Commissioner.*—The analyses are reported in detail without tabular statement or summary. The following table made up from the text of the article gives a general idea of the nature of the foods examined:

| Article. | Number of samples examined. | Number of samples below standard. |
|---|---|---|
| Vinegar | 218 | 148 |
| Syrups, honey, etc. | 76 | 41 |
| Catsups | 28 | 21 |
| Canned goods | 121 | 43 |
| Flavoring extracts | 81 | 65 |
| Beverages | 40 | 32 |
| Miscellaneous | 52 | 23 |

Attention is called to the fact that these samples were examined because they were suspected by the inspectors and the report does not give a correct idea of the average foods upon the market. The statement is made that the character of the foods on the market has greatly improved, as a result of the inspection, and that the samples recently purchased contained a lower percentage of adulterated articles.

W. D. BIGELOW.

**Food Inspection.** BY L. H. VAN WORMER, State Analyst. *Bulls. 113, 114 and 115, Michigan State Dairy and Food Department.*—During the months of January, February and March 136 samples of foods were examined, 85 of which were pure and 51 adulterated. The chief varieties of foods studied were flavoring extracts, dairy products, syrups and fruit products.

W. D. BIGELOW.

**The Composition of Cider as Determined by Dominant Fermentation with Pure Yeasts.** BY WM. B. ALWOOD, R. J. DAVIDSON and W. A. P. MONCURE. *Bull. 150, Va. Agr. Expt. Sta.*—This report treats of a continuation of a series of experiments upon the manufacture of cider begun by the Virginia Station in 1901 in coöperation with the Bureau of Chemistry of the United States Department of Agriculture. The history is given of a large number of fermentations with different yeasts and the composition of the must and of the finished cider, as well as of samples taken at different stages of fermentation.

The composition of the finished ciders is very uniform in regard to specific gravity of the cider and sugar-free solids. The fermentation of the sugars was practically complete. Notwithstanding this, the content of alcohol varied widely even in samples prepared from the same must. This difference in alcoholic content also was accompanied by a lack of uniformity in other characteristics, such as effervescence, aroma and flavor.

The bulletin also gives the analyses of 24 samples of commercial cider.

W. D. BIGELOW.

**Nineteenth Annual Report of Ohio Dairy and Food Commission.**—A general statement is given regarding the work of the Commission during the past year. The names of the chemists making the analyses are not included. The following table is made up from the detailed tabular statement contained in the report:

| Article. | No. samples adul. | No. samples pure. | Total. | Grand total. |
|---|---|---|---|---|
| Condiments | 1 | 3 | 4 | 4 |
| Dairy products | 311 | 1174 | 1485 | 1485 |
| Beverages | 14 | 5 | 19 | 19 |
| Drugs | 81 | 58 | 139 | 139 |
| Extracts and essences | 87 | 13 | 100 | 100 |
| Fruit, canned | 10 | 3 | 13 | 13 |
| Fruit juices | 3 | 4 | 7 | 7 |
| Jellies and jams | 4 | 4 | 8 | 8 |
| Fruit syrups | 1 | 2 | 3 | 3 |
| Flour | ... | 8 | 8 | 8 |
| Meat products | 25 | 3 | 28 | 28 |
| Miscellaneous | 213 | 117 | 330 | 330 |
| Oils | 50 | 31 | 81 | 81 |
| Relishes | 11 | 3 | 14 | 14 |
| Syrups | 90 | 56 | 146 | 146 |
| Vegetables, canned | 3 | 6 | 9 | 9 |

Total number of samples for year.............. 2394

W. D. Bigelow.

**Soil Treatment for the Lower Illinois Glaciation.** By C. G. Hopkins and J. E. Readhimer. *Bull. 99, Ill. Agr. Expt. Sta.*—A statement is given regarding fertilizer, lime and crop rotation experiments conducted at several different points on a gray silt loam, moderately well supplied with potassium, deficient in nitrogen and organic matter, very deficient in phosphorus and markedly acid, which covers a large area in the southern part of the state. The figures of the plot work, while somewhat erratic, confirm in general, the indications of chemical analysis, phosphorus proving to be very deficient and the use of lime necessary for the growth of red clover and alfalfa. Ground limestone has proved to be a suitable and available source of lime and is said to produce "practically no effect except to correct the acidity of the soil." The value of potassium which so far has produced marked increase in yields is not regarded as definitely settled, the authors being inclined to believe that the soil supply may be drawn on to supply all needs for this element. Nitrogen, in conjunction with crop rotations containing a legume, has not proved profitable.

F. P. Veitch.

**Experiments on Accumulation and Utilization of Atmospheric Nitrogen in the Soil.** By E. B. Voorhees and J. G. Lipman. *Bull. 180, N. J. Agr. Expt. Sta.*—The experiments were designed to show the relation of leguminous crops to soil nitrogen and to determine the value as a nitrogen carrier of the crop (cow peas) to subsequent non-leguminous crops. Cow peas were grown without nitrogenous fertilizer and with nitrate of soda, dried blood,

ammonium sulphate and manure in quantities which supplied the same quantity of nitrogen. Soluble and easily available forms of nitrogen were not as advantageous to cow peas as the more slowly available organic nitrogen. The results indicate that the application of readily soluble and available and concentrated nitrogenous materials to cow peas is poor economy. All the soils showed a gain in nitrogen content after cropping. This was greatest in the boxes to which no nitrogenous fertilizers were added. The succeeding crops of millet (two years) gave larger yields and removed more nitrogen from nitrogenous fertilizers than from the ground cow-pea vines. At the end of the three years' experiments the soils, except two, contained more nitrogen than could be accounted for by that originally present and that added from time to time. This gain was greatest in the ammonium sulphate series. This warning should be heeded. "It should also be remembered that in most soils the failure of leguminous crops to grow satisfactorily is due, not to the absence of the proper soil bacteria, but to general unfavorable soil conditions, to absence of sufficient amounts of lime, of a sufficient amount of humus, or of sufficient aeration. The inoculation of such soil without previous improvement would be waste of money." F. P. VEITCH.

**Concentrated Feeding-stuffs and Fertilizers for Sale in Wisconsin, 1905.** BY F. W. WOLL. *Bull. 120, Wis. Agr. Expt. Sta.* F. P. VEITCH.

**Licensed Commercial Fertilizers and Feeding-stuffs, 1905.** BY F. W. WOLL AND G. A. OLSON. *Bull. 122, Wis. Agr. Expt. Sta.*—Brief general discussion of the essential constituents, of the proposed use of fertilizers and analysis of a number of samples. F. P. VEITCH.

**Report on Tobacco Investigations in Wisconsin for 1903 and 1904.** BY E. P. SANSTEN. *Bull. 124, Wis. Agr. Expt. Sta.*—The bulletin contains results of fertilizer experiments comparing the effect of barnyard manure with various chemical fertilizers. As a rule, chemical fertilizers produced a larger yield than manure. F. P. VEITCH.

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## PATENTS.

NOVEMBER 1, 1904.

773,614. James Westaway, Liverpool, England. **Granulating fats.** The fatty substance is melted, thrown horizontally by centrifugal action, the flying granules meeting a stream of cooling fluid which cools and collects them.

773,636. Hans A. Frasch, New York. Recovering **nickel oxide and ammonia.** Nickel ammonium chloride is distilled with

calcium chloride and salt, expelling ammonia and precipitating nickel oxide, treating the fluid distilled and removed with calcium oxide, and returning the mixture to the distilling vessel, and repeating the process.

773,685. Elmer A. Sperry, Cleveland, Ohio. **Storage battery electrode.** Carbonate of lead is precipitated from a solution of a lead salt, roasted to expel $CO_2$, and pasted on to a support with a solution of ammonium sulphate, the latter salt being dissolved out after pasting.

773,746. Wm. A. Irwin, Dallas, Texas. Making **butter.** Equal parts of milk, twenty and ten hours old, respectively, are mixed at 70 to 80° F., as much pure butter added with sugar of milk, and the whole churned and worked.

773,784. Rudolph Brunck, Dortmund, Germany. Assignor to Franz Brunck, same place. **Ammonia** from distillation gases. The hot gases are passed in a finely divided state through concentrated acids in open vessels, at 80 to 85° C., the tar skimmed off, the crystallized salts baled out, and the remaining mixture returned to the vessels.

773,838-9. Merle J. Wightman, New York, N. Y. Assignor to Pyro-Electric Co., same place. **Thermoelectric generator.** The couples are provided with water-jackets communicating with each other so as to set up current flow in said jackets in the direction of the rise or fall of electromotive force.

773,904. Heinrich L. B. Toobe, Hornsea, England. **Lithographic plates.** Plates of zinc or aluminium are etched with a mixture of calcium chloride, potash alum, nitrous, nitric and sulphuric acids, zinc sulphate and hydrofluoric acid, the drawing is transferred and covered with a mixture of tannic, gallic, chromic and sulphuric acids in aqueous solution.

773,941. Carl Kellner, Vienna, Austria-Hungary. **Cellulose.** Plant cellulose is treated with alkali and then with chlorine made electrolytically in the presence of the material treated, the cellulose being a by-product of the electrolytic manufacture of alkalies from their chlorides.

773,961. Charles B. Morgan, Cleveland, Ohio. **Storage battery.** An aluminium plate is electroplated with nickel and the pockets filled with a mixture of granules of aluminium and active lead.

773,992. Carl F. Schlickeisen, Steglitz, Germany. **Peat fuel.** Half the peat is dried, comminuted, mixed with the wet peat, molded, dipped in oil and compressed.

774,003. Edward R. Stowell, Portland, Ind. **Fire-proof paint.** Equal parts of silicon carbide and sodium silicate are mixed with 3 to 10 per cent. of calcium carbonate.

774,025. Louis E. Barbe, Paris, France. Dry **cleaning**

**garments.** The garments are put in benzine in a heated closed cylinder with stirring, an inert gas being circulated through the cylinder, the solvent being removed from the cylinder and distilled from the garments, and the whole recovered in presence of the inert gas.

774,049. Julius Diamant, Raab, Austria-Hungary. **Lead peroxide accumulator plates.** Methyl-sulphonic and oxy-sulphonic acids are added to the electrolyte to produce electrolytic lead peroxide on lead plates.

774,069. Harry H. Goodsell, Leechburg, Pa. **Coating sheet iron or steel.** The sheets are exposed to steam at 900° F., and the temperature gradually reduced to non-oxidizing point.

774,083. Rudolph Knietsch, Ludwigshafen on Rhine, Germany. Assignor to Badische Anilin und Soda Fabrik, same place. Apparatus for **sulphuric anhydride.** Two vertical flues rise from a horizontal one, one of said flues having horizontal layers of contact material arranged in series across the flue and resting on pervious supports. through the center of which extends a supporting rod.

774,092. James Leslie, Belfast, Ireland. Making **carbon dioxide.** The hot gases from pure carbon burned in a closed vessel are led through a bicarbonate solution to liberate $CO_2$ and cool the gas which is led, under strong pressure, into a monocarbonate solution that is afterwards decomposed, giving pure $CO_2$.

774,109. Louis Roehm and Paul Walter, Chicago, Ill. **Fire kindler.** Pulverized resin 80, wood shavings 19, wood alcohol 1 part, compressed in briquettes.

774,118. Elihu Thomson, Swampscott, Mass. Assignor to General Electric Co. **Roentgen ray tube.** The tube is provided with a pocket containing a gas-yielding substance and an auxiliary cathode whose rays reach said substance when the vacuum becomes too high. The gas-yielding substance is potassium hydrate.

774,121. Curt H. Weigelt, Berlin, Germany. **Polishing marble.** The surface is exposed to dilute hydrochloric acid and shaken to remove air bubbles in a vacuum.

774,135. Chas. M. Dobson, New York, N. Y. **Distilling wood.** The liquefiable part of the wood is separated by moisture and heated below the charring point; it is then crushed and macerated, and the remaining liquid resin expressed.

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774,151. Jules A. Besson, Caen, France. Continuous process of making **chloral.** Alcohol is treated with chlorine and the chlorinated alcohol with moist chlorine, then distilled, and the products collected successively, and rectified with sulphuric acid and sodium bicarbonate.

774,156. Ludwik Champowich, New Britain, Conn. **Door**

**knob cement.** Sulphur 66, black lead 9, iron-bearing sand 4 parts.

774,167. Willis E. Everett, Tacoma, Wash. **Hardening armor plate.** A flux of alkaline cyanide is injected into the middle of the molten mass, together with molybdenum sulphide 10 per cent., manganese 5 per cent. and chromium and aluminium 5 per cent. each.

774,171-2. Wm. E. Garrigues, New York, N. Y. Distilling liquids and recovering **glycerol.** The first superheats steam by the vapors of the distilling liquid and injects it into the liquid to be distilled, the second neutralizes the spent soap-lye by a mineral acid, removes the insoluble fatty acids, concentrates the liquid and separates the mineral salts, filters off the volatile fatty acids and accompanying precipitate, and distils over the glycerol with alkali.

774,221. Edward T. Williams, Boston, Mass. **Food preparation.** Animal spleens are sterilized by heat, comminuted, and mixed with a sterilized decoction of red bone marrow, gelatin and celery.

774,224. Hugo Winternitz, Halle-on-Saale, Germany. Assignor to E. Merck, Darmstadt, Germany. **Halogenized fat.** Brominized sesame oil is emulsified with casein, and evaporated to a solid form.

774,260. Wm. MacMillan, Palmerston, North New Zealand. Making **leather.** Hides are steeped in sumac and water, then in alum and salt, and then dressed with neat's-foot oil.

774,286. Franz Suter, Berlin, Germany. **Cement.** Molasses 55, asphalt distillate and spirits 5 each, rosin 25 and copal 10 parts.

774,341. Frank N. Speller, McKeesport, Pa. **Recording calorimeter** for gas. A tube with a conical enlarged top is divided in three chambers, the upper and lower connected by an external pipe and automatic regulator whereby a uniform quantity of gas is burned in a given time, and the temperature of the chamber depends entirely on the calorific value of the gas, which is recorded automatically.

774,349. Nelson Campbell, Decatur, Ala. Henry R. Cassell, New York, N. Y. **Filtering slimes.** The liquid is filtered by suction in a tank, forming a thickened layer upon movable mantles, the non-adherent pulp is withdrawn from the tank, water introduced to recover the value of the adherent pulp in the tank, the water is removed from the tank, the mantles agitated to shake off the adhering pulp, and the thickened pulp is discharged through the bottom of the tank.

774,423. Joseph Heineman, New York, N. Y. **Lustrous composition.** Fine, pure aluminium powder, transparent varnish and sulphur. The varnish is a rubber varnish.

774,447. Sarah S. Muth, Syracuse, N. Y. Apparatus for **burning water.** A burner with inner and outer cylinders forming a flame carrier space between them, and a water vaporizing plate disposed to be heated by the flame in combination with a water supply duct disposed and gaged to apply water gradually to said vaporizing plate over and through the flame.

774,500. Alexander H. Stillwagon, Connellsville, Pa. **Waterproofing.** Rosin and alum 1 each, linseed oil and turpentine 2 each, copal 4, and tallow 8 parts.

774,535. James Rowan, Ottawa, Canada. **Safety paper.** Ordinary paper is first treated with a mixture of potassium prussiate, ammonia and water, and then with an overprint of ink containing ferric chloride, potassium iodide and an alkali.

774,591. Robert R. Maffett, Bayonne, N. J. Furnace for **smelting nickel.** An open-hearth smelting chamber, an elongated reducing chamber leading therefrom, charging openings lengthwise in said reducing chamber, stack flues and dampers at each end of the reducing chamber.

774,645. Fletcher H. Brooks, Baltimore, Md. **Cork substitute.** Rubber dissolved in ether, etc., is mixed with sulphur and cork or wood pulp, the mixture heated to drive off the solvent, molded and vulcanized.

774,677. Leonhard Lederer, Sulzbach, Germany. **Horn-like substance.** Cellulose acetate 1 and phenol 1.5 parts are fused at 40-50° C. Assignor to Central Stamping Co., N. Y.

774,679. Thomas M. Lunan, Newark, N. J. **Enameled ware.** A metal vessel receives a single coat of acid mottled enamel, and is then sprayed with ammonia, the metallic constituents of said enamel forming masses within the enamel of precipitated metallic hydroxide.

774,682. Michael F. Maginnis, Philadelphia, Pa. **Artificial fuel.** Powdered bituminous coal 2000, anthracite coal ashes 40, salt 120, linseed meal 20, and water 70 pounds.

774,705. James J. Shedlock, Little Bentley, England. **Artificial fuel.** A mixture of coal and tar is distilled in a closed vessel filled with an inert gas as superheated steam and the volatile portions condensed to a pitch-like coat on portions of the fuel that are afterwards briquetted.

774,713. Wm. H. Walker, Newton, Mass. **Cellulose acetate.** Horn-like substances, as photographic films, are produced by acting on cellulose acetate 10, with a phenol 5, and chloroform 100 parts.

774,714. As above, for **cellulose compound.** Cellulose acetate 10, chloroform 80, thymol 5, castor oil 3 parts.

774,727. Ludwig T. Peterson, Akron, O. **Reclaiming rub-**

**ber.** Shredded rubber is treated with a mixture of hydrocarbon and water at 300° F. in a closed vessel till devulcanized.

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774,779. Wm. E. Ranz, Youngstown, Ohio. **Aseptic cartridge.** An explosive package for toy pistol, etc., having its wrapper in part or in whole charged with aseptic material as mercuric chloride, etc.

774,804-5-6-7-8. All to Charles S. Wheelwright, Bristol, R. I. **Cooking garbage** and **recovering waste products.** A cylinder with conical ends with suitable steam supply, traps and connecting pipes.

774,824. Henry S. Blackmore, Mt. Vernon, N. Y. Assignor to Robert C. Mitchell, same place. **Alcohols and aldehydes.** Acetylene is made to react on ferric oxide, and the temperature maintained below the dissociating-point of the products formed, *viz.*, alcohols and aldehydes.

774,840. Eduard Gogler, Podgorze, near Cracow, Austria-Hungary. **White cement.** Lime 65, quartz sand 35, and alkaline carbonates 75 are ground together, the mixture melted and granulated, lixiviated in boiling water to the proper proportion of alkali, dried and ground.

774,869. Paul Drewson and John Parent, Shawano, Wis. Assignors to Drewson-Parent Construction Co. **Bisulphite liquor.** A long, circular tank has stirrers projecting through the bottom at regular intervals, the tank being supported from the top, with suitable gas supply pipe at one end and liquid supply at the other end with dams across the floor of the tank behind the stirrers.

774,946-7. Henry C. Mitchell, London, England. **Non-conducting coverings.** Mica flakes or asbestos is cemented with sodium silicate, the whole fused, molded and slowly cooled, making a dense, hard and vitreous product.

774,958. Tolmie J. Tressider, Sheffield, England. **Steel.** Contains carbon 0.30, manganese 0.25 to 0.30, nickel 2.25 to 2.30, and tungsten 0.28 to 0.32 per cent., the remainder being iron.

774,959. As above for **hardening the face of steel plate** by forging, or rolling and allowing it to cool, machining, reheating and slowly cooling, then reheating and quenching till a good fibrous surface is obtained, and finally heating uniformly and chilling.

774,973. Herbert B. Atha, East Orange, N. J. **Recarburizing scrap steel.** Finely divided carbon is put in sacks, the scrap and the sacks are bundled together, put into an open-hearth furnace, and the temperature raised till the steel absorbs the carbon.

774,976. Leon Blower, New York, N. Y. **Electroplating designs** on vitreous surfaces. The desired metal is powdered and mixed with a flux, laid on the vitreous surface in a design, fused, and its thickness increased by electrodeposition.

774,982. Jean Ferrand, Asnieres, France. **Paper pulp.** The bark of the Daphne or lace bark tree is soaked in water for a week, then passed through a chaff cutter, ground and bleached, etc.

775,031. Wm. S. Franklin, South Bethlehem, Pa. Assignor to Frederick Conlin, same place. **Electrical treatment** of material. An egg-shaped furnace has a funnel top through which an electrode passes that does not quite fill the opening, and the slag passes down into the furnace along side of the electrode which dips into the material in the furnace, and which material has passed through the arc and the slag.

775,060. Henry S. Blackmore, Mt. Vernon, N. Y. **Reducing aluminium.** Lithium and calcium oxides are fused, aluminium oxide added, and a current passed that will liberate the aluminium, and feeding aluminium oxide as it is reduced.

775,066. Armand Muller-Jacobs, Brooklyn, N. Y. **Preserving food,** etc. The substance is immersed in a suitable concentrated solution of a zirconium compound capable of emanating radioactive rays, as zirconium nitrate.

775,119. Gregoire Schlebie, Passaic, N. J. **Belt dressing.** Chalk 3, and spirits of camphor 1 part are mixed with linseed oil 16 and calcium chloride 12 parts.

775,123. Kristian Birkeland, Christiana, Norway. Apparatus for **electrolysis of gases.** Electrodes connected to a source of electricity are located in a powerful magnetic field, and are arranged to vibrate while supplied with a powerful current and with a current of gas flowing past.

775,187-8. John A. Lyons and Edward C. Broadwell. **Thermopile.** The first is an annular pile with a source of heat in the central well, concentric bars of copper, each particle electroplated with bismuth with concave polished inner surfaces and convex dark outer surfaces and loosely compressed pulverulent material in the spaces between the concentric rings.

The second has negative elements of mixed iron and lead sulphides and positive elements of copper phosphide and sulphide of copper.

775,222. Louis F. Kwiatkowski, New York, N. Y. **Artificial stone.** Ground unslaked lime is mixed with a portion of moist sand less than enough to hydrate it, thoroughly ground, and enough wet sand added to hydrate the lime, then it is molded and steamed under pressure, the steam saturated with alkaline salts.

775,241. George K. Hollister, Jr., New York, N. Y. **Artificial fuel.** Of anthracite (80 per cent.) gas coal (20 per cent.) 2000, clay 65, resin 45, muriatic acid 5, molasses 50, sulphate of iron 2, and alum 2 parts, the whole baked until dry and hard.

775,249. Ezekiel M. Roberts, Atlanta, Ga. **Beverage.** Glycerol 48, gum arabic 16, caffein 1, quinine 1/72 parts by weight.

775,251. Richard Schmidt, Holzminden, Germany. Assignor to Haarman and Reimer, same place. **Ionone homologues.** Acyclic or aliphatic homoionones are treated with dilute acids forming crude $\alpha$-cyclic homoionones to which concentrated acids are added at less than 40° C. and the cyclic homoionones are separated and purified.

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775,359. Charles S. Brand, Knowle, England. Condenser for Belgian **zinc retort.** The end of the condenser next the retort proper has a packing of broken fire-clay crucibles through which the zinc vapors pass to be collected in a pocket on the under side of the condenser.

775,360. **As above** for a condenser with a bridge wall near the inner end in place of a pocket.

775,367-8-9. All to Max Kugel, Wiesdorf near Cologne, Germany. Assignor to Farbenfabriken, Elberfeld Co., New York, N. Y. **Anthracene dyes.** All are hydrazine derivatives, respectively green, blue, and green-blue in color, derived from aminobromanthraquinones heated with nitrobenzene, cupric chloride and anhydrous sodium acetate, soluble in concentrated sulphuric acid green, brown and olive-brown respectively, their alkaline solutions exhibiting many of the typical properties of a "vat," on suitable reduction with hyposulphite and caustic soda.

775,384. George M. Pressel and Otto Fisher, Indianapolis, Ind. Assignors to Daniel C. Keely, same place. **Fire-brick glaze.** Fire-clay 250, salt 20, New Orleans molasses or sugar 3, carborundum 7, sodium silicate 12 parts by weight and water sufficient to make a thin batter.

775,405. Frederic H. Long, Chicago, Ill. Extracting **metals.** The bottom and top of a conical-bottomed tank are connected by a pipe, through which air is forced into the lower end of the cone by which a constant circulation of the mixed ore and cyanide solution is kept up.

775,414-5. John J. Berrigan, East Orange, N. J. Assignor to Francis J. Aren, New York, N. Y., and John Bernstrom, Stockholm, Sweden. **Centrifugal separator for precious metals.** The first has supply bin and feed tank with screw conveyor to mix pulverized ore and cyanide solution and to deliver the mixture to a centrifugal, and the second relates to the construction of the centrifugal itself.

775,472. Hugo Jone, Chicago, Ill. **Converting heat into electricity.** A negative plate of carbon and a positive plate of tin are combined with an alkaline electrolyte at a high temperature of 150° to 200° C., the oxidation of the metal producing a current and the oxide being reduced again by burning carbon; the waste heat is used in heating the cell.

775,502. Edward J. Sheehan, Pasadena, Cal. Assignor to San Gabriel Valley Essential Oil Co., same place. Extracting **orange peel,** etc. The peel is ground and squeezed to remove water, then exhausted by a solvent as $CS_2$ or benzine and the solution evaporated and the oleo-resin dried.

775,509-10. John J. Berrigan, Orange, N. J. Assignor to De Laval Separator Co., N. J., of the last. **Centrifugal.** Has a loose discharge tube movable under centrifugal force, the apparatus being adapted for cyanide work. The first is assigned to Francis J. Aren, New York, N. Y., and John Bernstrom, Stockholm, Sweden. It is for a process of extracting precious metals, which consists in projecting the comminuted ore through a chemical solution adapted to dissolve the metal, the enriched solution being separated from the gangue by a centrifuge.

775,546. Edward J. Sheehan, Utica, N. Y. Assignor to San Gabriel Valley Essential Oil Co., Pasadena, Cal. **Oleoresinous citrus product.** The oleoresinous product from orange and lemon peel, containing in addition to the known terpenes and aldehydes, acid and neutral resins amounting to 6 to 10 per cent., its specific gravity being at 15° C. 0.864 and its optical rotation 52.75.

775,548. Paul Weiller, Vienna, and Arthur Weiller, Trieste, Austria-Hungary. Separating **metals from ores.** Ores of first and second group metals are crushed, mixed with iron filings and saltpeter, and the metal reduced in a small furnace.

775,570. August L. Laska, Offenbach-on-Main. Assignor to K. Oehler, same place. **Dark blue sulphur dye.** Dinitrophenylchlorhydroxytolylamine is heated with alkali polysulphides to 100° to 125° C., forming a dye soluble in concentrated sulphuric acid blue, and in sodium sulphide solution green-blue, which solution precipitates brown flocks on adding hydrochloric acid.

775,597. Henry R. Cassel, London, England. Extracting **gold.** Pulverized ore is agitated with an electrolyte containing a cyanide, a bromide, and a chloride of a soluble base, and a high current of 10 amperes per square foot of anode surface is passed, thus precipitating the gold from the solution.

775,631. Robert McCarrel, Jacksonville, Fla. **Cement.** Hydraulic lime, damp sand and ground coral 2 parts each, add ½ part of ground granite and cool, mix in 1 part of Portland cement, dampen and tamp in molds.

775,635. Louis C. Rugen, Bound Brook, N. J., and Herbert Abraham, New York, N. Y. Assignors to Standard Paint Co., Bound Brook. **Oil cloth.** A fabric is impregnated with a plastic hydrocarbon, as tar or pitch, then with a mixture of a resin a fat and color, and the whole fused together.

775,747. Edmund Doberenz, Leipzig-Reudnitz, Germany. **Invisible pictures.** The picture is made in copying color (soluble

in water) to which a coat of dry (metallic) color is applied, covering up the picture that is brought out by moistening with water.

775,752. Fredrik Jahn, Ridley Park, Pa. Assignor to Harrison, Bros. & Co., Philadelphia, Pa. **Barium hydroxide.** A strong solution of barium sulphide is electrolyzed in an anode compartment separated from the cathode compartment by a porous partition, with a large anode and small cathode, whereby barium hydroxide and polysulphides are made and the barium hydroxide is separated.

775,780. Joseph Schneibel, Weehawken, N. J. **Brewing.** A peptonized malt mash is instantaneously mixed with a hot peptonized mash or other heating medium of starch-converting temperature, and resting the mixture till starch conversion has taken place.

775,809-10. Max Englemann, Elberfeld, Germany. Assignor to Elberfeld Co., N. Y. **Dialkylbarbituric acid.** The first is for desulphurizing the 2-thio-4-4-6-diimino-5-dialkylpyrimidines and secondly in splitting off the imino groups in 4-6 position by saponification. The second patent condenses thiourea with dialkylated malonitriles by means of alkali, then splits off the imino groups from the remainder by saponification, and finally desulphurizes the resulting product.

775,814. Curt Gentsch, Vohwinkel, near Elberfeld, Germany. Assignor to Elberfeld Co., New York, N. Y. **Phenol compound.** One molecule of the potassium salt of *m*-cresol is combined with 3 molecules of *m*-cresol, forming white needles reacting alkaline, melting at 88° C. and splitting off *m*-cresol on heating to a higher temperature.

775,818. Philip J. Handel, Meriden, Conn. **Chipping glass.** The surface is coated with mineral paint, which is allowed to harden, then is coated with a strongly adhesive material as glue which is dried by heat, causing the surface to flake off in an ornamental manner to frost the glass.

775,822. Karl Hufnagel, Silberhutte-Anhalt, Germany. Assignor to Edward R. Wagner, New York, N. Y. **Pyrotechnic compound.** Yellow and red phosphorus 1 part, potassium chlorate 3, red clay 2, and gum arabic 5 parts. For torpedoes.

775,829. Isidor Kitsee, Philadelphia, Pa. **Paper pulp.** The wood is immersed in a saline bath as sodium chloride which, after a period, is electrolyzed and thereby converted into a caustic bath.

775,839. Philip Magnus, Collingwood, Victoria, Australia. Treating **leather.** The leather is first cleaned and dried, then immersed in a mixture of benzene 85, benzin 10, naphtha 3, and kerosene 5 parts, drying the leather and adding to the first bath Para rubber and isinglass, then repeating the steps as many times as required.

775,887. Walter F. B. Berger, Little Rock, Ark. Assignor to American Bauxite Co., same place. **Fire-brick.** Ground bauxite with 20 per cent. fire-clay.

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775,909. Harold B. Anderson, Cleveland, Ohio. **Dust preventive** on roads. An emulsion of oil and water is sprinkled over the road and the water evaporates.

775,919. Wm. A. Hall, Bellows Falls, Vt. **Paint.** Talc or whiting 400, corn oil 25, casein 20, potassium oxalate 2, boracic acid 2, creosote 1 and water 170 parts with or without 3 parts formaldehyde.

775,953. Max Voight, Charlottenburg, and Albert R. Frank, Berlin, Germany. Assignors to the firm Cyanid Gesellschaft, Berlin, Germany. **Cyanides.** Metallic cyanamides are dissolved in water, the solution filtered and the separated cyanamide melted by heat under pressure with the base of the cyanide desired.

775,978. Max Kerschbaum, Holzminden, Germany. Assignor to Haarman and Reimer, Chemische Fabrik zu Holzminden. **Sesquiterpene alcohol.** A fragrant oil derived from oil of cassia, etc., having the formula $C_{15}H_{26}O$, boiling at 160° C. at 10 mm. pressure, having a density of 0.885 at 18° C., its index of refraction being 1.488, forming ethers by union with acids, resisting decomposition by alkalies which resinify the impurities and allow them to be removed, and forming by oxidation an aldehyde whose semicarbazone makes white leaves melting after previous softening at 133° to 135° C.

776,011. Sallie T. Boyd, Glasgow, Ky. **Fire-extinguishing composition.** Water 8000, sodium chloride 750, sifted wood ashes 500, concentrated lye 250 parts.

776,076. Ludwig Mack, Stuttgart, Germany. **Plaster of Paris compound.** Raw gypsum is mixed with resin or sulphur, 2 per cent. and calcined at 150° C.

776,145. Charles V. Potter, Balaclava, Australia. Separating **metals from sulphide ores.** Dilute sulphuric acid is made to react on the soluble sulphides present to generate hydrogen sulphide gas on the surface of the ore particles, whereby they are made lighter and raised to the surface whence they are removed.

776,171. Henry C. Caldwell, Buffalo, N. Y. Assignor to J. P. Dudley, W. T. Shepard, and Arthur B. Underhill, same place. Method of producing complete **combustion.** Finely divided carbon is made into a paste with water and delivered into a combustion chamber maintained at a high temperature by external heat, so as to decompose the water.

776,187. Wm. A. Koneman, Chicago, Ill. **Reclaiming rubber.** The rubber waste is disintegrated and heated with caustic alkali, and the rubber torn from the fiber, which is further divided,

washed in alkali and dissolved in acid, the product being washed and dried.

776,192. Achille Meygret, Paris, France. Covering for **storage battery plates.** The plates are dipped in a mixture of cellulose tetracetate and cellulose butyrate.

776,211. Alfred T. Abbey, and Frederick J. Esmond, Victoria, Canada. **Fluorescent indicator.** An incandescent lamp has a band of resilient fluorescent material with serrated upper edge and thumb pieces bent around the socket of the lamp.

776,264. Abrecht Schmidt and Fritz Bethmann. Assignors to Meister Lucius und Brüning, all of Höchst-on-Main, Germany. **Blue sulphur dye.** Dialkyl-*p*-amino-*p*-hydroxy-*m*-chlordiphenylamine is heated with sulphur and sodium sulphide 1 part to 4. A blue-black powder soluble in sulphuric acid dark blue, slightly soluble in alcohol with violet-red fluorescence, almost insoluble in glacial acetic acid, and dyeing unmordanted cotton blue in an alkaline sulphur bath.

776,314. Adolph Frank, Charlottenburg, Germany. Making **ammonia.** Water is added to cyanamide in the proportion of 3 molecules to 2 atoms of nitrogen in the cyanamide and at 300° C., whereby formates of the metals bound in the carbide used in making the cyanamide are also obtained with the ammonia.

776,365. Mark R. Spelman, New York, N. Y. **Composite fuel.** Coal is ground to a fine flour in molasses, thinned with crude alcohol and burned as a spray, by pumping through pipes.

776,373. Michael Andes, Wilkes-Barre, Pa. **Block fuel.** Anthracite 4, bituminous dust and Portland cement 1. each and fibrous material as cotton waste, old rope, etc.

776,424. Charles H. Rider, St. Louis, Mo. Treating **gold and silver ores.** Pulverized ore is charged into a tank containing dilute sulphuric and nitric acids to dissolve the silver which is removed in solution, then a solution of aqua regia is added to the ore and the gold dissolved out; the two solutions are remixed, whereby the silver is precipitated as chloride.

776,430. Adolph Seigle, Lyon-Monplaisir, France. **Artificial stone.** Lime and zinc oxide are ground and mixed with much silicious matter, the mixture is moistened with calcium chloride to a plastic state, then molded and steamed under pressure.

776,453. Alfred W. Case, Highland Park, Conn. **Artificial leather.** Leather scrap is compressed into sheets and coated with wax which is heated to liquefaction and kept melted till the pores of the leather are filled.

776,460. Louis A. Garchey, Paris, France. **Artificial graphite.** A refractory material as magnesium carbonate is applied to the inside of the mold, a colored oxide is mixed with melted glass

and filled in the heated mold, powdered mica being added thereto while the mold is filling, and finally slowly cooling the mass.

776,470. Frederic E. Ives, Weehawken, N. J. **Composite color print.** A safety composite color print has a subground design in white or colorless material opaque to ultra-violet spectrum rays, and a ground of juxtaposed colors which collectively absorb all of the visible spectrum in rays, in combination with a distinctive design or picture in transparent color which is a mixture of all of the ground colors.

776,480. Achille Meygret, Paris, France. Protective **coating for battery plates.** The plates coated with active material are dipped in a solution of cellulose tetrabutyrate.

WM. H. SEAMAN.

# REVIEW OF AMERICAN CHEMICAL RESEARCH.

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WILLIAM A. NOYES, Editor.




## GENERAL AND PHYSICAL CHEMISTRY.

**The Physician of the Future.** BY H. W. WILEY. *Science*, 21, 841–849.—Address to the graduating class of the medical and dental schools of the George Washington University, May 30, 1905. The first thing for the physician of the future to see to is the quality of the food supply. Predigested and prechewed foods are an evil. Future generations should have something to chew and digest, lest the organs become atrophied. Among the greatest foes to rational medicine is the nostrum. The author inveighs bitterly and justly against the secret patent or proprietary remedy. The character of the medical profession will be largely molded by the growing preponderance of preventive medicine. The laws of good living and sanitation will be better taught and become better known. The physician will perhaps become largely a public officer, and his emoluments be rated by the degree of health which is maintained. The future ought to see the medical man enter more into public life and assume all the duties of a nature which relate to the public welfare. "Finally the physician of the future will find his greatest service in prolonging human life." W. F. HILLEBRAND.

**The Education of Technical Chemists.** BY L. M. DENNIS. *Chem. Engineer*, 1, 357–360.—The above paper is in continuation of a discussion opened in the November number of the *Chemical Engineer* (see this Journal, 27, R. 321). Professor Dennis takes exception to some of Professor Ramsay's recommendations (*J. Soc. Chem. Ind.*, September 15, 1904) for the mingling of beginners and advanced students in laboratory work under modern conditions. He also deprecates the teaching of commercial methods and industrial processes in the laboratory. Pure and not applied science should be emphasized. Properly trained in the manner outlined in the paper, the young chemist will quickly

grasp the details of industrial methods and processes and "will bring to the solution of practical problems a wealth of resource that will soon place him ahead of his less broadly educated competitor." W. F. HILLEBRAND.

**What Constitutes a Chemical Engineer?** BY WM. H. WALKER. *Chem. Engineer*, 2, 1–3.—After showing how unwarranted, on historical grounds, is the attempt of some mechanical engineers to restrict to their own profession the use of the term "engineer," the author deprecates the tendency in our educational institutions to magnify training in specialized technique at the expense of "a broad knowledge of the laws of nature and the general principles of physical science" and of that clearness and independence of thought which is so necessary in successful scientific work. The employer is held to be largely responsible for this condition, which has resulted in such subdivision and so many special courses that it is impossible for the institution offering the latter to produce broadly trained chemical engineers. Graduates must in the end depend largely on their employers for the training characteristic of and incident to their specialties. "The coming engineer, be he chemical or otherwise, will be more and more a man of affairs." W. F. HILLEBRAND.

**The New Course for Chemical Engineers at Columbia University.** BY E. H. MILLER. *School of Mines Quart.*, **26**, 267–271; *Chem. Engineer*, 1, 400–404.—"The object of the course described is not in any way to supplant the present training for men who mean to devote themselves exclusively to chemistry but to provide a kind of chemist, not now produced, for whom there is a demand by the chemical manufacturers of America." It is hoped to attain this object in a four years' course by exacting higher entrance requirements, so that the students' time shall be devoted entirely to chemistry, engineering, metallurgy, mathematics, mechanics, physics and mineralogy. Some of the best high schools can provide the requisite preparation, but better would be a couple of years of college training for the culture studies, particularly English. W. F. HILLEBRAND.

**Life and Chemistry.** BY CHARLES BASKERVILLE. *Science*, **21**, 641–648.—Inaugural lecture on the assumption of the head professorship of chemistry in the College of the City of New York, February 28, 1905, which does not lend itself to the preparation of a brief abstract. W. F. HILLEBRAND.

**On the Molecular Depression of the Freezing-point of Water Produced by Some Very Concentrated Saline Solutions.** BY L. C. DECOPPET. *J. Phys. Chem.*, **8**, 531–538.—The author gives a report on earlier investigations which deal with the freezing-point of very concentrated solutions and with the occurrence of a minimum in the value of the molecular freezing-point lowering.

The salts which show a minimum are: $NH_4Cl$, $NaCl$, $BaCl_2$, $MgSO_4$, $ZnSO_4$, $CuSO_4$, while $Sr(NO_3)_2$, $Ba(NO_3)_2$, $Pb(NO_3)_2$, and $Na_2CO_3$ show a continuous decrease with increasing concentration. The author emphasizes the fact that he already offered as an explanation of the continuous decrease of the molecular depression that this might be due to the dissociation of hydrates or to the hydrolytic dissociation of the solute. It must however be mentioned that the hypothesis of the existence of hydrates according to Jones and Getman (This Journal 27, R. 67) is not supported by the decrease of the freezing-point lowering, but by its increase after passing through a minimum. W. BÖTTGER.

**The Electrolysis of Acid Solutions of Aniline.** BY LACHLAN GILCHRIST. *J. Phys. Chem.*, 8, 539–547.—It was found that by electrolysis of normal hydrochloric acid in presence of 0.1 N aniline, aniline black is formed. The more exact investigation by determination of the current electromotive force curve showed that decomposition occurs at a voltage of 0.95 (small anode and hydrogen cathode) in hydrochloric acid solution as well as in presence of sulphuric acid. Also the theoretical conclusion was proved correct that chloranilines are formed if the conditions for exhaustion of the aniline in the neighborhood of the anode were favorable so that chlorine was evolved. During the electrolysis of aniline solution in presence of hydrobromic acid no aniline black is formed, but probably *s*-tribromaniline. This is obvious as the decomposition voltage of hydrobromic acid (0.75 volt) is lower than the formation voltage of aniline black. *m*-Nitraniline shows a "break" in the decomposition curve at a higher voltage 1.42 volt. By sucking air through a solution containing platinum foil no formation of aniline black could be observed. W. BÖTTGER.

**An Analytical Study on the Deposition of Aluminum from Ethyl bromide Solution.** BY HARRISON EASTMAN PATTEN. *J. Phys. Chem.*, 8, 548–65.—The author has made an exact study of the fact mentioned by Plotnikow that aluminum can be deposited electrolytically from a solution of $AlBr_3$ in ethyl bromide, by determining the decomposition curves for dilute and concentrated solutions with platinized and polished platinum electrodes, as well as with aluminum electrodes. It was found that a current density of 0.0023 ampere per sq. cm. is just sufficient to compensate the solvent action of the solute upon the aluminum in the concentrated solution (40.95 per cent.). A more dilute solution (4.38 per cent.) gave no aluminum even at moderately high current density. Aluminum has a single potential of 1.10 ($\pm$0.2) volts against a 40.95 per cent. solution, and bromine a single potential of 1.20 ($\pm$0.02) volts. An aluminum anode which has been stripped of its film electrolytically gave 2.235 volts in a 9.38 per cent. solution of $AlBr_3$ in

ethyl bromide against a platinum cathode. Similarly magnesium gave 2.2 volts. As the dielectric constant of ethyl bromide is as low as 8.9, this case is a striking exception to the Nernst-Thomson rule. As to the aluminum anode phenomena the author assumes that a film likewise appears in solutions which are free from oxygen, but the high counter-pressure mentioned by Isenburg and Cook for aqueous solutions could not be observed. For commercial purposes this solution is not practicable.

W. BÖTTGER.

**Molecular Attraction, III.** BY J. E. MILLS. *J. Phys. Chem.*, 8, 593-636).—In the first place the author shows that the expression $\frac{L-E}{\sqrt[3]{d}-\sqrt[3]{D}}$ (see this Journal 27, R. 309) holds constant even in the immediate neighborhood of the critical temperatures, the larger discrepancies, which were observed earlier, being introduced by the use of the Biot formula. In order to discover the source of variations in the expression, the author studies the graphical representation of P, V, and internal heat of vaporization as a function of temperature, and also of L—E as a function of $\sqrt[3]{d}-\sqrt[3]{D}$. Further the latent heat of vaporization is calculated for twenty-one substances at different temperatures according to the Kirchhoff equation, that of the author, and an equation given by Crompton. The agreement between the results of the first two formulas is very satisfactory for normal substances while the disagreement increases at higher temperatures for associated liquids. The values computed from the formula of Crompton are at low temperatures, that is, at low vapor pressures, considerably too large; at the highest temperatures the agreement is satisfactory. For the variations of heat of vaporization with temperature there could be found no empirical formula; only at low vapor pressures and for a limited range of temperatures the heat of vaporization decreases linearly with rising temperature. In the last chapter the author discusses some relations resulting from the latent heat equations, an application of Crompton's theory verifying the proposed law of molecular attraction, and the extension of the theory to the energy relations at the critical temperature. The results of these considerations cannot be given briefly.

W. BÖTTGER.

**Crystallization in Binary Systems.** BY WILDER D. BANCROFT. *Z. physik. Chem.*, 46, 87-88.—In this article is shown how the nature and the relative amounts of the phases which are formed during slow cooling in binary systems may be determined graphically if the crystals are removed as fast as they are formed, provided no solid solutions occur. The same method is, of course, applicable to cases where a change of the solid phases may occur but where this change is very slow in comparison with the rate of cooling.

W. BÖTTGER.

**Solubility and Size of Particles.** By G. A. Hulett. *Z. physik. Chem.*, 47, 357–67.—The author answers a remark of Kohlrausch which was understood by the author to mean that Kohlrausch denies the existence of any relation whatever between solubility and size of particles. In this paper the author shows conclusively that a supersaturation of 20 per cent. produced by the addition of finely divided gypsum powder to the normally saturated solution could only be attributed to the higher solubility of the fine powder and not to the admixture of another substance. The value for the conductivity of a solution saturated with gypsum at 0° is 5 per cent. too high. Natural gypsum seems to be an extremely pure product, for in one case 10 grams dissolved in nitric acid (1.4), did not give any reaction for chlorine, and in another a very slight one which corresponded to a content of 1.4 parts of chlorine to 100,000 parts of gypsum. The occurrence of supersaturated solutions is also proved indisputably in the case of barium sulphate. As a supersaturated state of a solution is removed only very slowly, the author recommends the use of only larger particles for exact work and the rotation of the liquid instead of the whole system, so as to avoid grinding up the particles. The influence of size of particles seems to be of the same order of magnitude for different substances, and is therefore especially a source of error when very slightly soluble substances are used. W. Böttger.

**Significance of Change in Atomic Volume, IV. The Effect of Chemical and Cohesive Internal Pressure.** By Theodore William Richards. *Z. physik. Chem.*, 49, 15–40; *Proc. Am. Acad.*, 39, 581–604.—The author presents in this paper further arguments for the significance of the change in atomic volume and also for the theory of the compressible atoms. In the first place he discusses the view that the more compressible the elements are the greater is the change in the volume of a compound for a given affinity. It is shown in this connection that for the halides of lithium, sodium, and potassium the ratio of change in volume to heat of formation is smaller, the smaller the compressibility of the elements of the compound. Some apparent exceptions, silver and zinc chlorides, cadmium and zinc chlorides and also carbon disulphide, are discussed, and it is shown that under equal conditions the more volatile compound (that with a smaller cohesion) has the larger molecular volume. From the point of view that an atom highly compressed requires for the production of the same change of volume the application of a greater pressure than one less compressed, that both chemical and cohesive attraction act as compressive forces, and that the former is the stronger, it is shown that a given change of chemical energy causes a smaller change in volume than an equal change in cohesive energy. The possible complications caused by polymerization and crystallization are discussed in the cases of water

and tin. Also for a number of organic isomeric substances the relations between density, compressibility, and boiling-point are discussed in connection with polymerization, and it is especially interesting that there is given a possible explanation of the fact that the additivity of the molecular volume only holds if the less volatile liquid (with a higher cohesion) is heated up to a higher temperature. Finally the author presents arguments for the view that the change of other physical properties, such as viscosity and malleability may also be explained by a change in the intensity of the "Binnendruck." W. BÖTTGER.

**On the Vapor Pressure of Mercury at Ordinary Temperatures.** BY EDWARD W. MORLEY. *Z. physik. Chem.*, **49**, 95.—The method consisted in passing a current of dried carbon dioxide through mercury which was very carefully purified. The loss of mercury was found by weighing, and the volume of gas sent through the apparatus was found by means of a gas measuring apparatus. The values found are given in the following table:

| 10°. | 30°. | 40°. | 50°. | 60°. | 70°. |
|---|---|---|---|---|---|
| 0.0010 | 0.0027 | 0.0052 | 0.0113 | 0.0214 | 0.0404 mm. |

The values correspond fairly well to those calculated by the formula: $p=ab^t$, where log $a=4.6064$, $b=0.02856$. The observations are in good agreement with those of Hertz and of Ramsay and Young. W. BÖTTGER.

**Mercury Sulphate and the Normal Cell.** BY G. A. HULETT. *Z. physik. Chem.*, 49, 483–501.—It was found that the manner of preparation of mercurous sulphate has a distinct effect on the electromotive force of the Weston cell. However, a very uniform and reliable product is obtained when a current (0.5 ampere) is passed through a cell consisting of an anode of very pure mercury, a cathode of platinum, and sulphuric acid (1.6) as electrolyte. The mercurous sulphate is kept in motion on the surface of the metal by a stirrer. A number of cells prepared with this salt showed very concordant electromotive force for a time of ten weeks. It was also proved that the standard cell contains some mercuric sulphate. The ratio $Hg^{\cdot}/Hg^{\cdot\cdot}$ was found to be 40. The method employed was quite ingenious, it consisted in precipitating the mercurous ions as chloride after separation from the mercury and in shaking the filtrate again with mercury. In presence of mercuric ions a layer of mercurous chloride appears on the surface of the mercury. The hydrolysis of mercurous sulphate was found to take place probably according to the reaction:

$$3Hg_2SO_4 + 2H_2O = (HgOH)_2(Hg_2SO_4) + 2HgHSO_4$$

In connection with this question the solubility of mercurous sulphate in 1/250–4 sulphuric acid of different strengths was studied at 25°. It was also found that for the electrolytic prep-

aration of mercurous sulphate the acid should be more concentrated than molal, the concentration threefold molal being found to be the most convenient. The electromotive force of a cell constructed according to the prescription of the author is 1.01908 volts at 21.1°. In an appendix the determination of mercurous ions as chloride is discussed; and it may be mentioned in this connection that the precipitate is dried in a vacuum desiccator at ordinary temperatures, since even at 110° a continuous loss in weight is observed. W. BÖTTGER.

**Chlorine in Barium Sulphate Precipitated by Barium Chloride.** BY G. A. HULETT AND L. H. DUSCHAK. *Z. anorg. Chem.*, **40**, 196–217.—The essential results of this careful investigation may be summarized as follows: The content of chlorine in barium sulphate can be determined in a convenient and exact manner by dissolving the product in concentrated sulphuric acid and passing through the solution a current of an indifferent gas (air) which passes afterwards through a dilute solution of silver nitrate. The chlorine that is only superficially absorbed can be easily separated from that which is occluded by washing, for this was shown to be a reliable method by washing a precipitate of $BaSO_4$ which was produced in presence of $BaCl_2$ and another one which was free from chlorine but which had been shaken with a solution of $BaCl_2$, whereby no occlusion occurs. The content of occluded chlorine decreases if the precipitate is rotated for a long time with the solution from which it was produced. There is also a parallelism between the decrease of the content of chlorine and the change of size of particles. Between the concentration of the $BaCl_2$ solution and the content of chlorine no relation exists. The percentage of occluded chlorine is smaller when precipitated from a hydrochloric acid solution than when precipitated from a neutral solution. A new observation was made as to the behavior of barium sulphate on heating over 300°. The pure salt which has been dried at 140° loses water as far as 500°, the salt which contains chlorine, gives out water and hydrochloric acid during heating as far as 650°, without showing alkaline reaction towards phenolphthalein. Between 650° and 900° it does not change in weight, while it decreases in weight when heated still higher in air free from carbon dioxide. The heated product reacts alkaline towards phenolphthalein. The different phenomena are discussed from the standpoint that besides the barium sulphate some of the salt $BaClHSO_4$ is formed from the univalent cathion BaCl and the anion $HSO_4$. For the arguments for this assumption the reader may be referred to the original. Among the facts which support this view may be mentioned that the quantity of $BaSO_4$, when precipitated from a solution of magnesium sulphate and barium platinocyanide which do not contain intermediate ions, is in very good agreement

with the calculated values. Finally it may be stated that in order to correct for the content of occluded chlorine, according to Richards, the barium sulphate must not be heated higher than 700°. W. BÖTTGER.

**A New Electric Furnace and Various Other Electric Heating Appliances for Laboratory Use.** BY H. N. MORSE AND J. C. W. FRAZER. *Am. Chem J.*, **32**, 93–119.—The authors report on furnaces which were constructed for carrying out in a suitable manner the process of drying porous material, such as is needed for the preparation of cells for the direct measurement of osmotic pressure. The detailed construction of these furnaces can not be given in a short review. It may, however be mentioned that the authors describe other applications of this furnace, for instance, for the determination of the melting-point of material which melts at a high temperature; and also a number of graphite furnaces for hot-air baths. The latter make it possible to maintain a certain temperature for a long time and in a more economical manner than by heating with gas. Similar arrangements can be used as substitutes for oil and paraffin baths. W. BÖTTGER.

**On the Solubility of Barium and Mercuric Chlorides.** BY H. W. FOOTE AND H. S. BRISTOL. *Am. Chem J.*, **32**, 246–251. —At 25° a solution saturated with varying mixtures of $HgCl_2$ and $BaCl_2$ has always the same composition, showing that no double salt crystallizes out of the solution at this temperature. As, however, the concentration of both salts in the mixture is considerably higher than for the solubility of the single salts, it is evident that a complex is formed in the solution. The study of the behavior of a mixture of the salts with a saturated solution in a dilatometer showed that at about 17.2° a transition takes place. At a lower temperature (10.4°) a double salt of the composition $BaCl_2.3HgCl_2.6H_2O$ was obtained. The salt $BaCl_2.2HgCl_2.2H_2O$, described by Bonsdorf, does not form under the conditions given by him. W. BÖTTGER.

**On the Solubility of Potassium and Barium Nitrates and Chlorides.** BY H. W. FOOTE. *Am. Chem. J.*, **32**, 251–253. —It could be shown that the double salt $2KNO_3.Ba(NO_3)_2$, described by Wallbridge, forms at 25° under a moderately wide range of conditions, from solutions containing 15–27 per cent. $KNO_3$ and 6–2 per cent. $Ba(NO_3)_2$. By crystallization from water solution it is decomposed. Barium and potassium chloride do not form a double salt. W. BÖTTGER.

**The Thermo-Chemistry of the Theory of Electrolytic Dissociation.** BY JOSEPH W. RICHARDS. *Chem. News*, **89**, 31–32 and 37–40.—In this paper which was read at the meeting of the American Electrochemical Society at Niagara Falls in September,

1903, the author states that the internal change during the process of neutralization, the formation of $H_2O$ from $H^{\cdot}$ and $OH^{\cdot}$ ions, is not a chemical action but a physical one. It is comparable with the change from the gaseous into the liquid condition. As a support of this view he considers the fact that the heat of neutralization is equal to the energy (expressed as heat) which corresponds to the transformation of vapor exerting a pressure of 6.19 atmospheres at 18° into liquid water, and also the fact that the heat of formation of water from $H^{\cdot}$ and $OH^{\cdot}$ increased by the work involved in the expansion from 6.19 to 1 atmosphere is equal to the heat of formation of vapor of water from oxygen and hydrogen gas. Not only are these calculations questionable, but the same is true of the thesis that the "ionized" condition of a molecule in dilute solution is merely a certain physical condition of the compound and that "ionization" is in no sense to be regarded as a resolution or decomposition of the molecule into its constituents. W. BÖTTGER.

**Report of the Committee on the Cadmium Cell to the American Institute of Electrical Engineers.** *Chem. News*, 90, 225–227.—It is mentioned that at least some of the irregularities which are observed after setting up the standard cells, when pure mercurous sulphate of the trade is used, are due to a content of mercurous nitrate. These irregularities disappear if mercurous sulphate prepared electrolytically according to Hulett (R. 448) or Wolff (next review) is used. Furthermore, the committee offers in this report provisional specifications for the preparation of mercury, the saturated cadmium sulphate solution, cadmium amalgam 12.5 per cent. (by electrolysis), mercurous sulphate (Hulett-Wolff), the paste and for the construction of the cell. For cells constructed with these materials, containing a saturated solution and an excess of solid cadmium sulphate, the name "Weston Normal Cell" is proposed. W. BÖTTGER.

**Standard Cells.** BY F. A. WOLFF. *Electrochem. Industry*, 2, 174–176.—The author discusses the definition of the three fundamental electrical units (ohm, volt, and ampere) and comes to the conclusion that the volt in addition to the ohm should be used as a second independent unit. The advantages of and reasons for this procedure are mentioned in detail. Of the most commonly known standard cells, the Clark and Weston cells, the latter seems to be displacing the former. A number of portable cells supplied by the Weston Electrical Instrument Co., which contain a solution saturated at 4°, showed during a continuous observation for one year and a half differences which do not exceed a few parts in 100,000. There is further described a method for the electrolytic preparation of mercurous sulphate, which can be obtained in a very pure state, free from mercuric salt.

W. BÖTTGER.

**The Theory of Indicators and Its Bearing on the Analysis of Physiological Solutions by Means of Volumetric Methods.** By G. H. Clowes. *Am. J. Pharm.*, 76, 453–467 and 511–525.—The author presents in this paper a qualitative theoretical consideration of the behavior of chemical indicators which, however, from a physico-chemical point of view is not quite correct in all respects. (There may be mentioned only the statements at the end of page 455 and also the end of page 457 and the beginning of page 458.) The different indicators are divided into three groups: (1) those which are especially sensitive to alkalies, such as benzopurpurin, congo red and lacmoid; (2) those which are equally sensitive to alkalies and acids, such as alizarin, haematoxylin, litmus, and rosolic acid; (3) those which are especially sensitive to acids, such as phenolphthalein and Poirier's blue. The different topics which are treated in this paper are the behavior of indicators towards mineral and organic acids, towards bases, sodium hydroxide, ammonia, etc., and the amino bases, and towards proteids, albumoses, peptones, etc.; the use of indicators in titration of normal stomach contents; the titration of tryptic digestion products; the constitution of proteids; blood serum and the titration of urine. The summary occupies several pages. Because of the special character of the results they cannot be reviewed in this Journal, and any one who is interesetd in these questions is referred to the original article.

W. Böttger.

**Graphics of Carbon Disulphide with Formulas and Vapor Table.** By Thomas M. Gardner. *J. Frank. Inst.*, 156, 291–299.—The different properties, such as external heat, internal latent heat, total heat and entropy, which have been calculated in order to judge of the value of this liquid as a working fluid for heat engines, are communicated in this article. W. Böttger.

**Radioactivity of the Atmosphere.** By S. J. Allan. *Phil. Mag.* (6), 7, 140–150.—The radioactivity collected from the air by a wire charged to a high negative potential decays, according to an exponential law, to half value in forty-five to forty-eight minutes. The result is the same whether the wire be of lead, copper or iron. A piece of leather, moistened with ammonia, rubbed over the wire, removes much of the radioactive deposit. The activity of the leather decays at the same rate as that of the wire. The activity is removed less completely by felt moistened with ammonia, and the activity of the felt decays at a somewhat slower rate. The ash of active felt is active and this activity decays to half value in about forty-five minutes. The active matter from the air gives both $\alpha$- and $\beta$-rays. The $\alpha$-rays are completely absorbed by 0.004 cm. of aluminum or 10 cm. of air. The absorption by other solids and gases was studied. The radio-

activity of freshly fallen snow and rain is due to absorption of radioactive matter from the air. H. N. McCoy.

**The Radioactivity of Some Deep Well and Mineral Waters.** By Herman Schlundt and Richard Moore. *J. Phys. Chem.*, **9**, 320–332.—The activity of the emanation obtained by boiling 10-liter portions of the waters was measured both by electroscope and electrometer methods. The instruments were standardized by means of the radium emanation obtained from a known weight of uraninite of known uranium content. For well and spring water (four samples) the activity, expressed in terms of the unit representing the amount of radium emanation associated with $10^{-4}$ gram of uranium in a natural mineral, varies from 0.25 to 4.45. The activity of a sample of cistern (rain) water was 0.17. The average time of decay to half value of the emanation from these waters was three and a half days, which shows that the emanation is that of radium. It was found that about half of the emanation is given off with the gases that escape on heating the water to the boiling-point; the balance is given off on boiling. H. N. McCoy.

**A Radioactive Gas from Crude Petroleum.** By E. F. Burton. *Phil. Mag.* [6], **8**, 498–508.—A sample of crude petroleum from Ontario tested twenty-four hours after removal from the well was found to contain a strongly radioactive gas which is similar in its rate of decay and also in the rate of decay of the induced radioactivity which it produces, to the emanation from radium and to the emanations obtained by other experimenters from mercury and from many natural waters. This radioactive gas decays approximately according to the exponential law, falling to half value in 3.125 days. It produces an induced radioactivity whose rate of decay is such that it falls to half value in about thirty-five minutes. There are also indications in this petroleum of the presence of a more persistent radioactive substance than the radium emanation. H. N. McCoy.

**The Relation of Electrode Fall in Gases to the Contact Potential Series.** By C. A. Skinner. *Phil. Mag.* [6], **8**, 387–400.—The fall of potential at both electrodes was measured for eleven metals in H, N and O at pressures varying between 1 and 3 mm. The apparatus was so arranged that each metal could be made to serve, in turn, as cathode, respectively as anode, without change of pressure or stoppage of the current, which latter was furnished by a storage battery. The cathode fall increases, for small currents, linearly with the current density; it also increases at constant current density as the gas pressure diminishes. The series of metals arranged according to the magnitude of the cathode fall is the same for different gas pressures and current densities. The order of arrangement is ap-

proximately the same as in the contact potential series. The cathode fall is greatest for silver and least for aluminum. The cathode for gold is anomalous, being about the same as that of lead. There are also some other irregularities. The series is also approximately the same when the metals are arranged according to the magnitude of the anode fall, the latter increasing from platinum to zinc. The electrode fall is not a constantly increasing quantity in passing from one end of the series to the other but starting with a minimum value at one end, it approaches at a decreasing rate a constant maximum value for the rest of the series. H. N. McCoy.

**Penetrating Radiation Associated with the X-Rays.** By Carl Barus. *Science*, 21, 561–566.—The nuclei of the droplets constituting the fog, which forms when moist air is rendered supersaturated by sudden expansion, seem to be of two sorts: (1) fleeting nuclei, produced by relatively weak X-radiation, when the fog chamber is near the X-ray bulb, or by a powerful radiation at a distance of 2 to 6 meters; (2) persistent nuclei, produced by strong radiation near the fog chamber. The maximum persistent nucleation is produced only after several minutes. The fleeting nuclei are generated, within a second, by the radiation and their number is independent of the time of exposure to the radiation. About half of these fleeting nuclei (or ions) disappear in two seconds after the radiation ceases. The persistent nuclei are large; they persist for hours after the excitation ceases. They produce fogs with very little supersaturation. Fleeting nuclei, on which clouds have been caused to condense and shortly after evaporate, become quite persistent. Decaying nuclei can apparently produce new nuclei, on the average, 3 from each large nucleus. For very short exposures the nucleation is the same whether the bulb is 6 cm. or 6 meters from the fog chamber, but only in the former case, with prolonged exposure, is the effect cumulative, persistent nuclei resulting. It is thought that the radiation from the X-ray bulb is twofold in character; that the instantaneous effect (fleeting nucleation) is due to a $\gamma$-like radiation of sufficiently high velocity to penetrate appreciably several millimeters of iron at a distance of 6 meters; furthermore, that the cumulative effect (persistent nucleation) is due to X-light, proper.

H. N. McCoy.

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## MINERALOGICAL AND GEOLOGICAL CHEMISTRY.

**Some Crystalline Rocks of the San Gabriel Mountains, California.** By Ralph Arnold and A. M. Strong. *Bull. Geol. Soc. Am.*, Vol. 16, pp. 183–204; maps.—The following rocks are described: Biotite-granite, quartz-monzonite, granodiorite, hornblendite, aplite, micropegmatite, quartz-hornblende-porphy-

rite, diabase-porphyry, hornblende-diorite-gneiss, biotite-granite-gneiss, hornblende-schist, and garnetiferous schist. Defective analyses are given of two granodiorites, a hornblendite, and a hornblende-diorite-gneiss. W. F. HILLEBRAND.

**The Occurrence and Origin of Amber in the Eastern United States.** BY ARTHUR HOLLICK. *Am. Naturalist*, 39, 137–145; plates.—A recently discovered occurrence in the cretaceous deposits at Kreischerville, Staten Island, New York, is described. The amber is associated with vegetable débris, including lignite. Some of the organic remains have been identified as derived from a Sequoia, which is of interest in connection with similar associations of amber in Maryland and Japan, and with other coniferous trees elsewhere. W. F. HILLEBRAND.

**Check List of the Minerals of Rhode Island.** BY C. ABBOTT DAVIS. *Bull. 8*.—Roger Williams Park Museum, Providence, R. I., 12 pp. Sixty species are enumerated.

W. F. HILLEBRAND.

**The Tin Deposits of the Carolinas.** BY J. H. PRATT AND D. B. STERRETT. *North Carolina Geol. Survey, Bull. 19*, 64 pp.; maps, figures.—The tin veins have been found in rocks of two distinct geological formations: "(1) Those associated with the Archean gneisses, which are found in the vicinity of Gaffney, South Carolina; and (2) those associated with the schists, which are of a later period, and with which most of the North Carolina tin is found." Wood-tin has not been observed, but ordinary tin-stone and stream-tin occur abundantly. The authors state that the alluvial deposits will certainly pay to work, but that the economic value of the vein ore is as yet uncertain. Their idea regarding the origin of the tin ore found in the Carolina belt is, "that it is due partly to the direct separation or recrystallization of the cassiterite from the molten pegmatite magma, but it is also due to a fumarole action, resulting from the escaping vapors during the crystallization of the molten magma of pegmatite intruded into the schists and gneisses in the form of dikes, which in turn had thrown off apophyses and lens-shaped masses or 'augen,' that have been subjected to the same reactions as the main mass of pegmatite." The origin of tin ore elsewhere is briefly reviewed, its concentration and the extraction of the metal are touched upon, and there is a certain amount of statistical information in the report. W. F. HILLEBRAND.

**Fifth Annual Report of the Mining Bureau [Philippine Islands].** BY H. D. MCCASKEY. 44 pp.; maps, plates.—Besides matter of purely administrative character, the report contains brief summaries of the present status of mining and of the mineral resources of the Philippine group.

W. F. HILLEBRAND.

**Section of Mines, Annual Report for 1902.** By E. D. Ingall. *Ann. Rep. Geol. Survey, Canada*, Vol. 15, Part S., 280 pp.—The chemical matter of this report is covered by numerous analyses of coals and brines, the latter chiefly from Manitoba. The section on coal is also issued separately under the title "Mineral Resources of Canada, Coal." W. F. Hillebrand.

**Report upon the Mineral Statistics of the Island [Newfoundland] for the Calendar Year 1904.** By James P. Howley. *Geol. Survey, Newfoundland*, 29 pp. W. F. Hillebrand.

**Annual Report of Minister of Mines [British Columbia] for the Year Ending December 31, 1904.** 317 pp.; map, plates, figures.—The chemical matter to be found in the detail reports in this volume is covered by a few assays and partial analyses.

W. F. Hillebrand.

**Volcanic Rocks of New Brunswick.** By L. W. Bailey. *Trans. Roy. Soc. Canada*, Vol. 10, Sec. 4, pp. 123–138; plate.—Chemical matter is absent from this report.

W. F. Hillebrand.

**The Fluorspar Deposits of Southern Illinois.** By H. Foster Bain. *U. S. Geol. Survey, Bull. 255*, 75 pp.; maps, plates.—These are vein-deposits along faulting fissures. The vein material is essentially fluorite and calcite, with which are associated minor amounts of galena and sphalerite, and traces of other sulphides. Because of their envelopment by the resistant fluorite the sulphides have suffered little alteration and no traces of secondary enrichment have been observed, nor has a definite order of deposition been noted. "In general the ore-bodies are believed to be practically unmodified ores of primary deposition." The zinc and lead are not at present commercial products. Although no final statement as to the origin of the ores can yet be attempted, the author thinks that the evidence points to heated waters as the agency by which they were segregated, and that the waters obtained an essential part of their load from a large mass of lower-lying intruded rock, rather than from the surrounding limestones, the fluorine having been given off from the magma during its cooling and solidification. Because of the purity of much of the material it is believed the deposits already uncovered form the basis for an important industry.

W. F. Hillebrand.

**The Shelburne Meteorite.** By Leon H. Borgström. *Trans. Roy. Astronom. Soc. Canada*, 1904, pp. 71–94; plates.—This stony meteorite fell near Shelburne, Grey County, Ontario, August 13, 1904. From certain observed and assumed data the velocities at the time of impact of the two fragments found have

been calculated as 172–177 and 157–165 meters per second, respectively. The larger fragment weighed 12.6 kilos, and the smaller is reported to have weighed 6 kilos. It is the larger which the author describes. It is an irregular polyhedron, whose enclosing faces are all slightly concave or composed of two or more concave parts. The possible origin of these faces and the structure of the stone are fully described. It is to be classed with the "veined grey chondrites (cg a)." Fractional analyses were made, but only their combination is here reproduced: $SiO_2$, 39.19; Fe, 10.70; FeO, 15.16; Ni, 0.78; Co, 0.04; MnO, 0.12; $Al_2O_3$, 2.15; $Cr_2O_3$, 0.62; CaO, 1.75; MgO, 26.24; $K_2O$, 0.22; $Na_2O$, 0.73; S, 1.61; P, 0.06; total, 99.37. The mineralogical composition is approximately: Nickel-iron, 8.50; troilite, 4.50; chromite, 0.80; schreibersite, 0.40; olivine, 45.00; enstatite, 27.80; aluminum silicate, 13.00. Specific gravity of a 24-gram fragment, 3.499. The olivine is a variety rich in iron: $SiO_2$, 36.41; FeO, 23.22; $Al_2O_3$, 0.31; $Cr_2O_3$, 0.07; CaO, 0.33; MgO, 39.66; total, 100.00. The whole description is unusually thorough, for the most part.
W. F. HILLEBRAND.

**The Rodeo Meteorite.** BY O. C. FARRINGTON. *Pub. Field Columbian Mus., Geol. Series*, Vol. 3, No. 1, 6 pp.; maps, plates.—This medium octahedrite (Om) was found in 1852, about 12 kilometers northwest of Rodeo, Durango, Mexico, and weighed when received in Chicago 44.1 kilos. Analysis by H. W. Nichols afforded: Fe, 89.84; Ni, 8.79; Co, 0.28; Cu, 0.07; P, 0.80; S, 0.02; C, 0.09; total, 99.89. Besides numerous inclusions of schreibersite, which form an important feature in the structure of the meteorite, there was observed a black, amorphous, friable inclusion of what, to judge from its magnetism and chemical behavior, seems to be graphite with probably a carbide of iron disseminated through it. Troilite seems to be absent from the meteorite. Reasons are given for regarding the present iron as belonging to a fall distinct from those represented by the other four irons that are known from the State of Durango.
W. F. HILLEBRAND.

**On the Natural Iron-Nickel Alloy, Awaruite.** BY GEORGE S. JAMIESON. *Am. J. Sci.*, **19**, 413–415.—The author has analyzed a new find of the alloy from Josephine County, Oregon (josephinite of Melville), and describes material from a new locality at South Fork, Smith River, Del Norte County, California. The specimens from Oregon were water-worn pebbles, carrying silicious matter, probably serpentine. The composition of the alloy was determined after crushing the pebbles in a steel mortar and dissolving the metallic component by iodine suspended in water. The alloy from California was in grains about 0.15 mm. in diameter, occasionally running up to 1.5 mm. It was obtained from gold washings, and was mixed with mag-

netite and a little chromite. From these last the alloy was separated by solution in warm dilute nitric acid. The composition of the alloys, after deducting about 24 and 10 per cent., respectively, of foreign matter, is shown in the following table:

| | California. | | Oregon. | |
|---|---|---|---|---|
| Fe | 25.24 | 25.11 | 21.45 | 21.28 |
| Ni | 74.17 | 74.30 | 76.60 | 76.79 |
| Co | 0.46 | 0.46 | 1.19 | 1.20 |
| Cu | ...... | ...... | 0.66 | 0.63 |
| P | 0.04 | 0.04 | 0.04 | 0.04 |
| S | 0.09 | 0.09 | 0.06 | 0.06 |
| | 100.00 | 100.00 | 100.00 | 100.00 |

Making allowance for the magnetite, the specific gravity of the California alloy is 7.85. The alloys are so similar in composition to those known to occur elsewhere that the author regards it as unfortunate that so rare a substance should have received three different names, awaruite, josephinite and souesite. From its association with serpentine in Oregon and with chromite at the other localities, it is suggested that the material may have separated from basic peridotite rocks. Having no tendency to oxidize it is found as a heavy constituent in adjacent river sands.

W. F. HILLEBRAND.

**Some Results of Late Mineral Research in Llano County, Texas.** BY WM. E. HIDDEN. *Am. J. Sci.*, **19**, 425–433; figures. —Under the auspices of the Nernst Lamp Co., of Pittsburg, Pa., extensive development work was done during the winters of 1902-1903 and 1903-1904 which resulted in the finding of large amounts of some of the rare-earth minerals for which this locality is noted, besides others. Especially noteworthy were a double crystal of gadolinite weighing 73 pounds, a roughly crystallized mass of the same mineral over 200 pounds in weight, an 18-pound mass of yttrialite, one of pure allanite weighing over 300 pounds, one of rowlandite weighing 1 kilo, besides thorogummite, fergusonite, a little nivenite, mackintoshite and tengerite (?). Polycrase (?) and menaccanite, both new to the region, were found, and also enormous masses of fluorite and orthoclase, and a crystal of smoky quartz exceeding 600 pounds in weight. Great masses of biotite seemed always to indicate the near-by presence of the rare-earth minerals. An analysis, by the reviewer, of the supposed tengerite gave: $Y_2O_3$ group (mol. wt. 226), 40.8; $Ce_2O_3$ group (mol. wt. 335), 7.0; $Fe_2O_3$, 4.0; BeO, 9.7; $CO_2$, 19.6; $H_2O$ at 105°, 3.2; $H_2O$ above 105°, 14.1; $SiO_2$, 0.4; MgO, Alk., loss, 1.2. This indicates a basic hydrous carbonate, but whether a single carbonate or a mixture of two, it is impossible to say. The material was too scanty and not pure enough to admit of satisfactory analyses. All the minerals have been tested photographically as to radio-

activity. The order of intensity observed is as follows: Nivenite mackintoshite, thorogummite, yttrialite, fergusonite, cyrtolite. An interesting observation made was the existence of "unusually long radial lines projecting in many directions from the bodies of ore richest in thorium, uranium and zirconium." These the author called "stars" and sought for them as positive pointers to "ore." "While removing, piece by piece, a 70 pound mass of zirconium-yttrium-uranium and thorium ore, which was a nucleus to one of the best marked of these 'stars,' from its quartz matrix, my hands and face would begin to burn as if from the effect of strong sunlight, and after two or three days of this kind of mining a redness of skin and a burning sensation would be followed by actual soreness of the parts of my hands and face exposed to the direct emanations from the minerals. My assistant . . . complained of it also . . . ." The author is strongly inclined to ascribe this strange effect to the work of a radioactive element. W. F. HILLEBRAND.

**The Isomorphism and Thermal Properties of the Feldspars.** BY ARTHUR L. DAY, E. T. ALLEN AND J. P. IDDINGS, with an introduction by GEORGE F. BECKER. *Carnegie Institution of Washington, Pub. No. 31,* 95 pp.; plates, figures.—This is the full paper, of which Part I—Thermal Study—by Drs. Day and Allen, was reviewed (this Journal 27, R. 212) at the time of its appearance in the *Am. J. Sci.* Part II—Optical Study—by Dr. Iddings, needs no special comment here. In the introduction Dr. Becker reviews and comments on the work of Day and Allen, and emphasizes anew the need for a thorough study of rock eutectics with a view to the evolution of a rational system of rock classification. The plates illustrating the text are magnificent reproductions from photo-micrographs. W. F. HILLEBRAND.

**Cement Materials and Industry of the United States.** BY EDWIN C. ECKEL. *U. S. Geol. Survey, Bull. 243,* 395 pp.; maps.—From the letter of transmittal to the Director of the Survey, by C. W. Hayes, it appears that the author of this voluminous report "has visited every district in which cement was being produced and has examined nearly every plant in operation. Information relating to undeveloped deposits of cement materials has been obtained by personal examination and from the published and unpublished work of other geologists. The object has been to treat the subject from the geological rather than the technical standpoint, although the technology of cement manufacture is also discussed with sufficient fulness for the purpose of the report." The greater portion of the bulletin deals naturally with Portland cement and its raw materials, but the natural and pozzuolan cements receive attention. The many maps and hundreds of analyses add to its value,

but the reviewer finds no mention of the work of Clifford Richardson regarding the constitution of Portland cements.

W. F. HILLEBRAND.

**Geology and Cement Resources of the Tombigbee River District, Mississippi-Alabama.** BY E. C. ECKEL AND A. F. CRIDER. *Senate Document, No. 165, 58th Congress, 3d Session,* 23 pp.; map.—This report contains quite a number of analyses, many new, of Selma limestone, one of Midway clay and two of lignite from Dekalb, Mississippi. W. F. HILLEBRAND.

**The Portland Cement Resources of Southwestern Arkansas.** BY G. D. FITZHUGH. *Trans. Eng. Assoc. of the South,* 15, 33-42; map.—The deposits of chalk and clay described occur in Howard and Little River counties. Analyses accompany the report. On pages 171-177 there is a discussion of the paper.

W. F. HILLEBRAND.

**The Phosphate Deposits of the Southern States.** BY LUCIUS P. BROWN. *Trans. Eng. Assoc. of the South,* 15, 53–128; plates. —This is largely a résumé of our knowledge regarding the various forms of phosphate deposits occurring throughout the southern states. W. F. HILLEBRAND.

**Suggestions on the Treatment and Economic Preparation of the Alabama Coals for Coke Manufacturing.** BY L. A. O. GABANY. *Trans. Eng. Assoc of the South,* 15, 129–147.

W. F. HILLEBRAND.

**Geological Survey of Michigan, Annual Report, 1903.** BY A. C. LANE. 342 pp.; maps.—Besides the two papers noted in the next following abstract, there are to be found in this report, under the sections dealing with limestone and building and road materials, various analyses. There is also a very mathematical paper on the "Grain of Rock," another on the "Transmission of Heat into the Earth," and a reprint of "The Theory of Copper Deposition" already noticed in this volume, R 4.

W. F. HILLEBRAND.

**Water Supply of the Lower Peninsula of Michigan.** BY W. F. COOPER. *Geol. Survey, Michigan Ann. Rep., 1903,* pp. 47–109; maps. **Waters of the Upper Peninsula of Michigan.** BY A. C. LANE. *Ibid.,* 111–167.—These reports contain a large number of analyses, chiefly sanitary, of a great variety of waters.

W. F. HILLEBRAND.

**Superficial Blackening and Discoloration of Rocks, Especially in Desert Regions.** BY W. P. BLAKE. *Am. Inst. Min. Eng. Bimonthly Bull. No. 3,* 1905, p. 667.—An acknowledgment of prior expression by G. P. Merrill (*Bull. U. S. Geol. Survey No. 150*) of views similar to those put forth by the author in a paper

presented at the Lake Superior Meeting of the Institute of Mining Engineers (see this Journal **26**, R 443).

W. F. HILLEBRAND.

**Contributions to Mineralogy from the United States Geological Survey.** BY F. W. CLARKE, W. F. HILLEBRAND, F. L. RANSOME, S. L. PENFIELD, WALDEMAR LINDGREN, GEORGE STEIGER, AND W. T. SCHALLER. *U. S. Geol. Survey, Bull. 262*, 147 pp.; figures.—Several of the papers brought together in this bulletin have already been published elsewhere and noticed in this review. Those new or containing much new matter are referred to in the next following abstracts.

W. F. HILLEBRAND.

**[Tetradymite.]** BY W. F. HILLEBRAND. *U. S. Geol. Survey, Bull. 262*, p. 57.—A specimen of this telluride, of specific gravity 7.816 at 20° C., said to come from Fremont County, Colorado, had the following composition as the mean of a number of determinations: Bi, 52.14; Te, 46.62; Se, 0.20; S, 0.14; $Fe_2O_3$, 0.22; insoluble, 0.15; total, 99.47. Bi : Te+Se+S = 2 : 2.98.

W. F. HILLEBRAND.

**On "Californite."** BY F. W. CLARKE AND GEORGE STEIGER. *U. S. Geol. Survey, Bull. 262*, pp. 72–74.—A portion of the material supposed to be vesuvianite and to which G. F. Kunz gave the varietal name "californite" (see this Journal **26**, R 4) proved to have the composition of garnet, though singularly unlike ordinary garnet, being white and massive and somewhat resembling chalcedony. The analyses below (by Steiger) show the composition of (A) vesuvianite from the south fork of Indian Creek, 12 miles from Happy Camp, Siskiyou County, California; (B) vesuvianite from Fresno County, California, 35 miles east of Selma; (C) white garnet, found with or near (B).

| | A. | B. | C. |
|---|---|---|---|
| $SiO_2$ | 35.86 | 36.55 | 38.59 |
| $Al_2O_3$ | 18.35 | 18.89 | 22.24 |
| $Fe_2O_3$ | 1.67 | 0.74 | 0.45 |
| FeO | 0.39 | 0.74 | 0.36 |
| MnO | 0.05 | none | 0.10 |
| MgO | 5.43 | 2.33 | 0.64 |
| CaO | 33.51 | 35.97 | 35.97 |
| $H_2O$ at 105 | 0.29 | 0.58 | 0.31 |
| $H_2O$ above 105 | 4.18 | 3.42 | 0.80 |
| $TiO_2$ | 0.10 | none | none |
| $CO_2$ | ...... | 0.91 | 0.39 |
| $P_2O_5$ | 0.02 | ...... | ...... |
| F | none | 0.13 | 0.17 |
| | 99.85 | 100.26 | 100.02 |
| Less O for F | | 0.05 | 0.07 |
| | | 100.21 | 99.95 |
| Specific gravity | | 3.359 | 3.586 |

The interpretation of analysis C (garnet) offers no difficulty, but the case is otherwise with A and B. From a study of over forty analyses of vesuvianite the authors are led to suspect that the mineral may be a mixture of several similar molecules—$Al_2Ca_7(SiO_4)_6(AlOH)_2$; $Al_2Ca_7(SiO_4)_6(AlO_2H_2)_4$; $Al_2Ca_7(SiO_4)_6H_4$; $Al_2Ca_7(SiO_4)_6Ca_2$—the first and third usually predominating. Magnesium replaces some of the calcium, and in the variety wiluite BOH probably replaces AlOH. "Vesuvianite, then, is to be regarded as a basic orthosilicate, belonging to a group of compounds of which garnet is the normal salt . . Garnet, vesuvianite, epidote, and the scapolites must be considered together if the problem of their constitution is to be properly solved."

W. F. HILLEBRAND.

**The Action of Silver Nitrate and Thallous Nitrate upon Certain Natural Silicates.** BY GEORGE STEIGER. *U. S. Geol. Survey, Bull. 262*, pp. 75–90.—This is a continuation of earlier work (see this Journal **24**, R 449) on chabazite and analcite, having for its object the replacement of alkali metals and calcium by silver and thallium, respectively. The finely ground mineral and, in most cases, the dry nitrate were heated in sealed tubes at from 240-290°, the contents were leached with boiling water till the filtrate gave no test for nitrates, and the residue was then dried and analyzed. The minerals experimented with were analcite, leucite, thomsonite, chabazite, stilbite, natrolite, scolecite, mesolite, pectolite, elaeolite and aegirite. More or less replacement was found to have occurred in every case, and sometimes practically complete replacement, particularly by silver. In the case of pectolite under the action of silver nitrate a complex breaking-up of the molecule appears to have taken place, while aegirite seemed to be but little affected. The behavior of these two toward thallium nitrate was not ascertained. Elaeolite was but slightly attacked by thallous nitrate, no test being made with the silver salt. With thomsonite, chabazite, stilbite, natrolite, scolecite and mesolite the silver compounds appear strongly hydrated, though not invariably with the same amount of water as is found in the native mineral, while the thallium derivatives are practically anhydrous. It was found that the residue from treatment of chabazite contained several per cent. of $N_2O_5$. Attempts to replace the silver by lead in silver chabazite and silver analcite were partially successful. With exception of the isotropic compounds all the products were crystalline, but the crystals were too small to permit of determination of their forms.

W. F. HILLEBRAND.

**Dumortierite.** BY W. T. SCHALLER. *U. S. Geol. Survey, Bull. 262*, pp. 91–120; figures.—This is the more elaborate report, of which a condensation, appearing in the *American Journal of*

*Science*, has already been noticed in this Review, 27, 259. The history and crystallography of the mineral is here treated more exhaustively and there are some analyses of the rocks in which dumortierite is found in our western country and of associated minerals. Among the latter is a hitherto unpublished analysis by the reviewer of kyanite from Clip, Yuma County, Arizona: $SiO_2$, 36.30; $Al_2O_3(TiO_2)$, 62.51; $Fe_2O_3$, 0.70; FeO, (?); CuO, trace; Ign., 0.40; total, 99.91. Specific gravity at 18°, 3.656. Of interest is a comparison of the mineral composition of the rocks of the three western occurrences, where feldspar is entirely absent. Associated with dumortierite, quartz and muscovite in each case we have kyanite in Arizona, sillimanite in California, and andalusite in Washington, all having the same chemical composition. W. F. HILLEBRAND.

**Mineralogical Notes.** BY W. T. SCHALLER. *U. S. Geol. Survey, Bull. 262*, pp. 121–144; figures.—For some of the minerals described, see this Journal, 26, R 201, and R 260. Additional ones are the following: *Gyrolite*, from Fort Point, San Francisco, California: $SiO_2$, 53.47; $Al_2O_3$, 0.22; CaO, 32.00; $Na_2O$, 1.25; $H_2O$, 13.21; traces Fe, Mg and K; total, 100.15. Specific gravity, 2.39. *Tellurite*, Cripple Creek, Colorado, crystallography. *Prehnite*, Lower California: $SiO_2$, 43.48; $Al_2O_3$, 24.52; $Fe_2O_3$, 0.34; CaO, 27.19; $H_2O$, 4.49; total, 100.02. Specific gravity, 2.90. *Hornblende* and *tridymite*, Mono County, California, crystallography. *Zinnwaldite*, *Cassiterite* and *topaz*, Cassiterite Creek, east of Cape York, Alaska, crystallography. *Bournonite*, Big Bug district, Yavapai County, Arizona: S, 20.04; As, 2.81; Sb, 18.99; Pb, 40.21; Cu, 15.12; Fe, 0.35; Zn, 0.35; Mn, trace; insol., 1.67; total, 99.54. *Anhydrite*, Texas, exact locality unknown, peculiarly shaped crystals. *Glaucodot*, Sumpter, Oregon, crystallography and composition: As, 39.84; S, 18.46; Fe, 12.45; Co, 20.23; insol., 9.38; total, 100.36. *Pyrite*, Spanish Peaks, Colorado, crystallography. *Vanadinite*, Yuma County (?), Arizona, crystallography. Globular *lepidolite*, Mt. Mica, Maine. *Libethenite*, Yerington, Lyon County, Nevada, crystallography. W. F. HILLEBRAND.

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## ANALYTICAL CHEMISTRY.

**The Rotating Anode as a Means to Rapid Electrochemical Analysis.** BY WILLIAM H. EASTON. *Chem. Engineer*, 1, 386 (1905).—A comparison of gravimetric and electrolytic methods of quantitative analysis shows that the electrolytic method is extremely accurate and rapid, particularly when the rotating anode is used. An improved form of the apparatus for usual determinations consists in a spirally wound anode of platinum wire and an electric motor for its operation. The method of procedure is ex-

plained in detail and several test runs on copper, nickel, zinc and silver show an accuracy of 0.1 per cent. or less. A small bibliography of monographs on the use of rotating electrodes completes the article. R. C. SNOWDON.

## METALLURGICAL CHEMISTRY.

**Metallurgical Calculations. Application of Thermochemical Principles.** BY J. W. RICHARDS. *Electrochem. and Metal. Ind.*, April, 1905.—An explanation of thermochemical nomenclature and tables of thermochemical data for oxides, hydroxides, sulphides, selenides, tellurides, arsenides, antimonides phosphides, nitrides, hydrides, carbides, silicides, alloys, amalgams, fluorides, chlorides, carbonates, hydrocarbons, phosphates, silicates, borates, cyanates, cyanides, sulphates, bisulphates and some nitrates. In fact, all known thermochemical heats of formation useful in metallurgy. J. W. RICHARDS.

**A Canadian Dellwik-Fleischer Water Gas Plant.** BY E. A. SJÖSTEDT. *Iron Age*, March 16, 1905.—The gas produced averages CO 40 per cent., $H_2$ 51.5, $CH_4$ 0.5, $CO_2$ 5.0, $N_2$ 3.0, with an available heating power of 322 B. T. U. per cubic foot of gas. There is produced 70,000 cubic feet of this gas per ton of coke, against 34,000 cubic feet by the old water gas process. Two No. 4 generators can produce 20,000 cubic feet of gas per hour. The novelty of the producers consists in using a bed of coke not over 3 to 4 feet in depth, and blowing air through so vigorously, at such high pressure, that all the carbon burnt during heating up is burnt to carbon dioxide, by which means the coke bed is heated to a very high temperature in less than two minutes; steam is then admitted during eight to ten minutes, alternately at the top and bottom of the fire, so as to maintain uniform heating and prolong the life of the lining. The cost of the gas, running continuously with coke at $6 per ton, is 15 cents per 1,000 cubic feet. The steam requires for its production 15 to 20 per cent. of the amount of fuel used in the generator, making the net yield 75 to 80 per cent. of the heating value of the fuel obtained in the gas. Because of its high calorific power, the gas has a high calorific intensity, and is useful for many purposes without preheating of gas or air or use of the regenerative system. J. W. RICHARDS.

**Molasses as Fuel.** BY R. TERRY, S. ARNOLD AND H. FISHER. *School of Mines Quarterly*, April, 1905.—A calorimetric test in the oxygen bomb gave 2,903 calories as the calorific power, equal to about 5,225 B. T. U. per pound, or 36.8 per cent. of the calorific power of coal. (The detail data given in the paper are evidently erroneous.) An evaporative test showed 1.41 pounds of water evaporated per pound of molasses burned, or 1.682 pounds

from water at 212° F to steam at 212° F. The molasses was atomized by steam, and burnt like oil; it atomizes much better when preheated to 130° F. than when cold. At present, molasses is usually sprinkled on bagasse (1 to 5) when burnt, but where there is no bagasse, the use of the atomizer and burning like oil is practicable. J. W. RICHARDS.

**An Electro-thermic Muffle Furnace.** BY F. A. J. FITZ-GERALD. *Electrochem. and Metal. Ind.*, April, 1905.—In purely commercial work, the amount of material produced per kilowatt-hour is the important item. Muffle furnaces were constructed by the writer and Mr. Bennie, and run with 20 kilowatts of power, either as 180 amperes at 110 volts or as 360 amperes at 55 volts. The furnace contained five muffles. The resister was amorphous granular carbon, packed around the muffles. Preliminary experiments showed that a temperature equal to the melting-point of steel was obtained in the muffles using 100 watts per square decimeter of surface of resister in contact with the muffles, the resister having best a total thickness of 8 cm. The amount of heat lost by radiation can be much diminished by making the bottom, sides and top hollow, and packing in poorly conducting material, such as infusorial earth. In a six-hour run the mean power used was 12.14 kilowatts, and the muffles, equal in weight to 250 pounds, were raised to 1100°. Assuming their mean specific heat 0.30, the useful effect was 82,500 pound calories, while the energy developed was $72.8 \times 1890 = 138,000$ pound calories, making the heating-up efficiency approximately 60 per cent. J. W. RICHARDS.

**New Assay-Furnace Tools.** BY E. KELLER. *Eng. Min. J.*, April 20, 1905. (Read before the American Institute of Mining Engineers.)—A fork is constructed consisting of five separate parallel forks each capable of holding five scorifiers; with this, twenty-five scorifiers can be placed in the muffle at once and withdrawn at once. In a modified fork, each one is revolvable around its axis, so that all five scorifiers held by a single fork can be poured at once. The cupels are placed in a row on a wide shovel, and raked off onto the muffle by a sort of wide hoe, thus manipulating a transverse row at once. Two other tools drop the lead buttons all at once into a row of cupels. J. W. RICHARDS.

**The Use of Waste Gases in Gas Engines.** BY M. ROTTER. *Iron Age*, March 16, 1905. (Read before the Illinois Steel Works Scientific Club.)—Coke ovens produce 8,000 to 10,000 cubic feet of gas per ton of coal coked, of which one-half is required for heating the ovens themselves, leaving half available for gas engines, which at a calorific power of 560 B. T. U. per cubic foot will develop in gas engines 200 effective horse-power hours per ton of coal coked. A blast-furnace produces 130,000 cubic feet of gas

per ton of pig iron made, of which about 57,000 cubic feet are needed to heat the blast, leaving 73,000 cubic feet available, which at a calorific power of 86 B. T. U. per cubic foot will develop in gas engines 600 effective horse-power hours per ton of pig iron made, and subtracting the 240 horse-power hours required by blowing-engines, pumps, hoists, etc., leaves available for outside use 360 horse-power for every ton of pig iron made per hour.

J. W. RICHARDS.

**Dry Air Blast in Iron Manufacture.** BY J. GAYLEY. *Iron Trade Review,* May 11, 1905. (Read before the American Institute of Mining Engineers.)—This is a continuation of the former paper of Mr. Gayley on the same subject. It records experiments with two similar furnaces, one of which was run on ordinary air, the other on dried blast, and then for a period of two weeks they were reversed, so as to prove conclusively the benefits of the dry blast. The results were as follows:

| | Tons produced daily. | Coke consumption. Pounds. | R. P. M. blowing-engines. | Av. temp. hot blast. °F. |
|---|---|---|---|---|
| No. 1 furnace: | | | | |
| January 1–10 (dried blast) ...... | 428 | 1,825 | 96 | 869 |
| " 15–31 (normal blast).... | 414 | 2,340 | 111 | 771 |
| No. 3 furnace: | | | | |
| January 1–10 (normal blast).... | 410 | 2,351 | 111 | 716 |
| " 15–31 (dried blast)....... | 432 | 1,811 | 96 | 802 |

These results were obtained in a month when the average moisture present in the air is a minimum. As the summer season approached, the furnace running on normal blast steadily decreased in output and increased in coke consumption, while the furnace supplied with dried air ran practically uniform.

J. W. RICHARDS.

**Coating Steel Wire with Lead.** *Brass World,* April, 1905.—In the Rodman process, the wire passes down through melted caustic soda into melted lead, and passing under a partition comes up out of the lead, the caustic soda being confined inside the partition. The caustic is also used as an electrolyte, a graphite anode dipping into it, while the lead beneath is the cathode. In this way the lead is kept continually charged with metallic sodium, which facilitates the alloying of it with the steel. The wire needs no pickling, as the melted caustic removes scale.

J. W. RICHARDS.

**Pyritic Smelting.** BY H. W. HIXON. *Eng. Min. J.,* April 13, 1905.—A discussion of when ordinary smelting passes into pyritic smelting. In smelting, an increased blast alone will cause an increase in tonnage smelted, an increased percentage of copper in the slag and an increased percentage of iron in the slag. If the coarse ore is charged against the sides and fine ore in the middle,

these conditions will be accentuated. It is difficult to define when pyritic smelting may be said to begin, but a good definition would be when "the slags show the characteristic peroxidation of the iron as evidenced by chilled samples refusing to decompose in acids. If a chilled sample will not give white silica on analysis without fusion, it has been produced under conditions of oxidation characteristic of pyritic smelting."

J. W. RICHARDS.

**Zinc Mining and Smelting in Southwestern Virginia.** BY E. HIGGINS, JR., *Eng. Min. J.*, April 6, 1905.—The ore obtained on the lead mine tract carries 28 to 30 per cent. zinc, 8 to 10 per cent. lead and 8 to 10 per cent. iron; the gangue is principally zinciferous clay (containing from 15 to 16 per cent. of zinc), a little limestone and less silica. It is crushed and jigged until a lead concentrate is obtained averaging 65 per cent. lead, 7 per cent. zinc and 5 per cent. iron, which goes to a Scotch hearth; the slag from this hearth goes to the slag furnace. The zinc concentrate is dried and calcined in a rotary roaster, and then to Wetherill magnetic concentrators, giving heads carrying 44 per cent. zinc, 1.5 lead and 5 iron, the tails carry 48 per cent. iron and 5 to 6 zinc. The mill treats altogether 90 tons of ore per ten hours. There is an oxide plant in which low-grade ore and tailings running under 15 to 20 per cent. of zinc are treated. The rich concentrates are reduced in Welsh-Belgian furnaces, each having 140 retorts and producing 1,800 to 3,000 pounds of zinc daily. There are ten such furnaces. The recovery is 85 to 90 per cent. of the zinc in the charge. The residues carry 1.5 to 4 per cent. of zinc, and are thrown away. Three grades of zinc are made: the "Bertha" carries less than 0.04 per cent. of impurities, the "Old Dominion" 0.50 per cent., the "Southern" about 1 per cent.

J. W. RICHARDS.

**Roasting and Magnetic Separation of a Blende Marcasite Concentrate.** BY H. O. HOFMAN AND H. L. NORTON. *Technology Quarterly*, March, 1905. (Read before the American Institute of Mining Engineers.)—The ignition temperature of marcasite was found to be 378° C., for blende 600°. The ore was crushed, roasted and magnetically separated. The conclusion reached is that blende and marcasite in the concentrate tested "can be successfully separated by crushing through a 20-mesh screen, roasting from five to ten minutes at a temperature not exceeding 600° C., and then subjecting to two double-pole magnets, the first having less than half the strength of the second."

J. W. RICHARDS.

**Cadmium in Commercial Zinc.** BY W. R. INGALLS. *Eng. Min. J.*, April 13, 1905.—Average samples of many car-loads of ore from the Joplin district have shown 0.33 to 0.72 per cent. of

cadmium. The first draw of metal from the zinc retorts carries often as high as 0.5 per cent. of cadmium (with lead under 0.5 per cent.). Drillings of cadmium-bearing spelter are brittle and easily broken up with pestle and mortar; drillings fall from the drill in small chips. It is doubtful if the amount of cadmium in commercial spelter has any appreciable effect on the quality of brass, but the exact effects have not been accurately determined.

J. W. RICHARDS.

**Castings for Hydraulic Purposes.** *Brass World*, April, 1905.—
—The following alloy has been found by experience to be the best: copper 90 parts, tin 6, phosphor tin (5 per cent. phosphorus) 4, to which may be added not over 2 parts of lead to make it cut easier, but the metal will be sounder and the castings more uniform without the lead. J. W. RICHARDS.

**Platinoid.** *Brass World*, April, 1905.—This is alloy used largely for electrical instruments. An analysis showed: copper 54.04 per cent., nickel 24.77, zinc 20.42, iron 0.47, lead 0.15, manganese 0.15, tungsten (specially looked for) 0.00.

J. W. RICHARDS.

**Pure Metallic Nickel for Coinage.** BY A. L. COLBY. *Iron Age*, April 6, 1905.—A plea for substituting pure nickel for the present alloy of 75 per cent. copper and 25 per cent. nickel now used in our "nickels." The advantages given are, (1) greater resistance to wear, (2) better preservation of color, (3) increased value as scrap for re-melting, (4) extreme difficulty of counterfeiting, because of the heavy machinery required for stamping, (5) easy detection of alloy counterfeits, because of their not being magnetic. J. W. RICHARDS.

**Aluminum-bronze Firing Pins.** BY E. S SPERRY. *Brass World*, April, 1905.—The firing pins of the Springfield rifle are made of cast aluminum bronze, containing 10.5 per cent. aluminum and 89.5 per cent. copper. An alloy with 11 per cent. of aluminum is too hard and becomes brittle, while one with 10 per cent. is too soft, and upsets in use. The castings are forged hot to exact size, and then have a tensile strength of 95,000 pounds per square inch. They will not forge cold. Only the best lake copper and purest aluminum can be used; the alloy first made is cast into ingots and then re-melted to cast into shape, and no flux, phosphorus, manganese, zinc or tin is added.

J. W. RICHARDS.

**Cyanidation in the South.** BY H. E. MEGRAW. *Eng. Min. J.*, April 13, 1905.—The high percentage of failures in the gold mines of the south Appalachian region is due not so much to lack of gold as to antiquated metallurgical methods and non-scientific

mining. Ores carrying \$25 to \$30 per ton are not treated profitably by amalgamation, and the cyanide process has not been successful because of the slaty talcose character of the ores. At the Iola mine the cyanide process has been recently applied successfully to the amalgamation tailings carrying \$6 to \$10 of gold, at a cost of about \$0.50 per ton for labor, power and chemicals, the principal item of success being the division of the tailings into sands and slimes and the treatment of each separately. It is believed that this points the way to success in many other properties not at present profitably operated.

J. W. RICHARDS.

**Precipitation of Gold from Cyanide Solutions.** BY W. J. SHARWOOD. *Eng. Min. J.*, April 20, 1905. (Read before California Miners' Association).—A review of the various methods employed, and the following results of experiments: A solution was taken containing \$2.50 per ton of gold, \$0.20 per ton of silver, 0.015 per cent. of copper and 0.05 per cent. of free potassium cyanide. This was treated (*a*) by saturation with hydrogen sulphide, (*b*) acidulation by acid and filtration, (*c*) electrolysis for twenty-four hours with large surface of lead plates, (*d*) agitation with 0.0125 per cent. of its weight of zinc dust, and decantation, (*e*) agitation with zinc dust and filter pressing. The extractions were in percentages:

| | Gold. | Silver. | Copper. |
|---|---|---|---|
| (*a*) | 2 | 97 | 3 |
| (*b*) | 65 | 90 | 75 |
| (*c*) | 100 | 100 | 100 |
| (*d*) | 25 | 60 | 3 |
| (*e*) | 94 | 97 | 4 |

The following are the requirements for precipitating 100 tons of solution per day. *Electrolysis*: tank 1,200 cubic feet capacity with 3,000 square feet of anode and cathode surface, using 5 to 6 horse-power for current, and extracting about 90 per cent. of the values in solution. *Zinc shavings*: 100 cubic feet of zinc shavings, requiring 175 gross cubic feet of box room, using 25 to 30 pounds of zinc per day, and extracting 90 to 95 per cent. *Zinc dust*: one filter-press with 16 frames 24 inches square, working fifteen to sixteen hours a day, requiring 2 horse-power and 20 to 30 pounds of zinc dust; extraction 95 to over 98 per cent.

J. W. RICHARDS.

**Effect of Silver on the Chlorination and Bromination of Gold.** BY H. O. HOFMAN AND M. G. MAGNUSSON. *Technology Quarterly*, March, 1905. (Read before American Institute of Mining Engineers).—The aim of the work was to find the dissolving power of chlorine water and bromine water upon gold and upon a series of gold-silver alloys. Alloys were tested containing, 0, 10, 20, 30 and 40 per cent. of silver. The results were that a solution carrying

2.8 grams of chlorine per liter gave good extractions up to and including the 20 per cent. silver alloy; with 2.0 grams of chlorine, up to the 10 per cent. alloy and only 75 per cent. extraction on the 20 per cent. alloy; with 1.4 grams of chlorine over 90 per cent. extraction up to the 10 per cent. alloy, and less than 40 per cent. extraction on the 20 per cent. alloy; with 1.3 grams of chlorine the extraction was less than 50 per cent. on pure gold and still less with the silver alloys. There thus seems to be a critical strength, *viz.*, 1.4 grams of chlorine per liter, which must be used in order to get good chlorination, and with no strength is good extraction obtained when over 20 per cent. of silver is present. The results with bromine were somewhat parallel; there is a critical strength of 2.5 grams of bromine per liter below which the extractions fall off with very great suddenness; good extractions were obtained with this solution up to 20 per cent. silver, and with stronger solutions up to 30 per cent. silver; but above 30 per cent. of silver the extractions were poor with even the strongest solutions, 9 grams of bromine per liter. J. W. RICHARDS.

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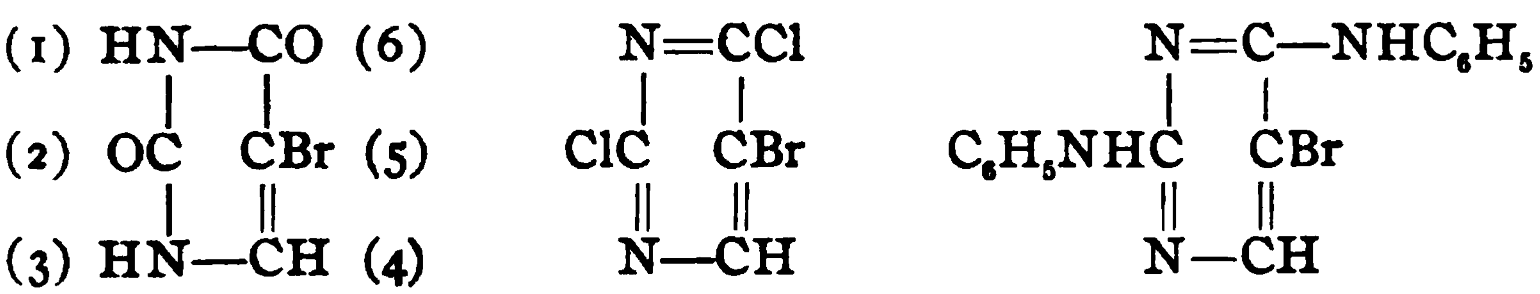
## ORGANIC CHEMISTRY.

**On Triphenylmethyl (Ninth Paper).** BY M. GOMBERG AND L. H. CONE. *Ber. chem. Ges.*, **38**, 1333–1344.—It is shown that triphenylmethyl combines directly with esters and hydrocarbons. *I. Compounds of Triphenylmethyl with Esters.*—The experiments were carried out with various alkyl esters of formic, acetic, propionic, butyric, valeric, oxalic, malonic, succinic, and benzoic acids. Sufficient hot ester was added to the triphenylmethyl to give a clear solution, and this solution was then allowed to crystallize in a cool dark place. The crystals obtained were washed either with the ester itself, or with petroleum ether (under such conditions that the latter would not combine with the triphenylmethyl), dried and analyzed. The results are tabulated. Of the various esters used in the experiments, methyl and ethyl formates were the only ones which refused to combine with the triphenylmethyl. The dissociation temperatures of these ester compounds depends upon the boiling-point of the ester, and is generally quite low. The dry compounds are comparatively stable at ordinary temperature. Those prepared with the more volatile esters contain one molecule of $((C_6H_5)_3C)_2$ to one of ester. With the higher boiling esters the results are less satisfactory. In the case of the esters of bibasic acids, only one of the carboxyls appears to react. The following structure for these ester compounds is suggested:

*II. Compounds of Triphenylmethyl with Aromatic Hydrocarbons.*—Compounds with benzene and toluene have been mentioned in previous papers. Others have now been prepared with ethylbenzene and with the three xylenes. In all cases, these compounds are made up of one molecule of $((C_6H_5)_3C)_2$ with one of the hydrocarbon. *III. Compounds of Triphenylmethyl with Petroleum Ether.*—The petroleum ether used was freed from aromatic and from unsaturated hydrocarbons, dried, and rectified over sodium. The portion boiling at 80-90° was used to dissolve the triphenylmethyl. The mixture was heated to obtain a clear solution, and on cooling transparent cubical crystals separated, containing approximately 15 per cent. of petroleum ether. Apparently it is necessary to heat the solution to obtain this addition product. It loses its petroleum ether but slowly *in vacuo*. Judging by analytical results, the hydrocarbons combined with the triphenylmethyl in these compounds are apparently unsaturated, one molecule of $((C_6H_5)_3C)_2$ being combined with one of the hydrocarbon, but how the saturated hydrocarbons composing the purified petroleum ether used are changed to these unsaturated ones is not clear. In the experiments previously reported upon the electrical conductivity of triphenylmethyl in liquid sulphur dioxide, the hydrocarbon was purified by precipitating its chloroform solution with petroleum ether. In view of the above results upon the combination of triphenylmethyl with hydrocarbons, some of the original sample of triphenylmethyl used in the conductivity experiments was examined for other hydrocarbons, and it was found to contain about 9 per cent. The figures previously reported for the conductivity are, therefore, about 10-15 per cent. too low. *IV. Compounds of Triphenylmethyl with Unsaturated Aliphatic Hydrocarbons.*—The amylene compound, $((C_6H_5)_3C)_2.C_5H_{10}$, was obtained in beautiful crystals. All the above addition-products, with esters and hydrocarbons, show the characteristic reactions of triphenylmethyl; thus, in presence of oxygen, triphenylmethyl peroxide is formed with liberation of the hydrocarbon or ester.

M. T. Bogert.

**Researches on Pyrimidines: The Structure of Some Substitution Products (Eighth Paper).** By Henry L. Wheeler and H. Stanley Bristol. *Am. Chem. J.*, 33, 437-448.—



I. II. III.

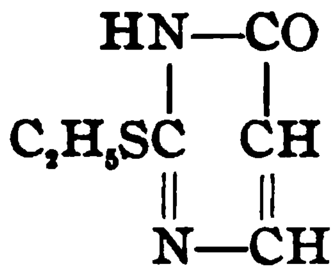
| IV. | V. | VI. |
| --- | --- | --- |
| HN—CO<br>\| \|<br>$C_2H_5SC$ CBr<br>\|\| \|\|<br>N—CH | HN—CO<br>\| \|<br>$C_6H_5NHC$ CBr<br>\|\| \|\|<br>N—CH | N=CCl<br>\| \|<br>$C_6H_5NHC$ CBr<br>\|\| \|\|<br>N—CH |

—When a pyrimidine derivative containing free hydrogen in positions 4 and 5 is acted on by halogens or by nitric acid, it has hitherto been a matter of doubt as to which hydrogen was replaced. The authors have now found a solution of this problem. It rests upon the structure of Behrend's nitro- and amino-uracils, in which the group is evidently in position 5. The action of nitric acid on uracil, on 2-ethylmercapto-6-oxypyrimidine, on 2-thiouracil, and on other pyrimidine derivatives, gives 5-nitrouracil. The bromination of uracil gives the 5-brom derivative. Reduction of the nitrouracil, or heating the bromuracil with aqueous ammonia at 180°, gives an aminouracil identical with Behrend's. 2-Alkylmercapto-6-oxypyrimidines also give 5-brom derivatives. This was proven as follows: 5-Bromuracil (Formula I) was converted into 2,6-dichlor-5-brompyrimidine (Formula II), and this, with aniline, gave the corresponding 2,6-dianilino-5-brompyrimidine (Formula III). 2-Ethylmercapto-6-oxypyrimidine was brominated, and the bromine derivative (Formula IV) treated with aniline; the 2-anilino-5-brom-6-oxypyrimidine (Formula V) thus formed was changed to the chloride (Formula VI), and the latter warmed with aniline. The product thus obtained was identical with the dianilinobrompyrimidine obtained above (Formula III) from 5-bromuracil. Prolonged boiling of 2-ethylmercapto-5-brom-6-oxypyrimidine with hydrochloric acid removes all bromine and gives uracil. In these 5-bromuracil compounds, an oxygen atom in position 6 renders the bromine at 5 more active than an amino group at 6 would. 2-Ethylmercapto-4-ethyl-5-brom-6-oxypyrimidine gives 4-ethyluracil when its solution in concentrated hydrochloric acid is evaporated dry. Several new pseudothiourea salts were prepared in the course of the work. EXPERIMENTAL.—The uracil used was prepared by boiling various 2-alkylmercapto-6-oxypyrimidines with concentrated hydrochloric acid. The pseudothioureas were prepared by treating pure finely pulverized thiourea with a little alcohol, adding the alkyl halide, warming on the water-bath until solution occurred, and then allowing the crystallization to take place *in vacuo* over sulphuric acid. The crystals were washed with ether, and were readily soluble in water or alcohol, insoluble in benzene or ether. Pseudoethylthiourea hydrobromide dissolves in acetone, is readily soluble in pyridine, and may be crystallized from acetic anhydride. *Pseudo-n-propylthiourea hydrobromide*, $C_4H_{10}N_2S.HBr$, long, colorless needles, m. p. about

60°. *Pseudo-i-butylthiourea hydrobromide*, $C_5H_{12}N_2S.HBr$, fibrous mass of crystals, melting at about 96°. *Pseudo-i-amylthiourea hydrobromide*, long prisms, melting at about 84°. *2-n-Propylmercapto-6-oxypyrimidine*, from the pseudo-*n*-propylthiourea hydrobromide, ethyl sodium formylacetate and alkali, crystallizes from 40 per cent. alcohol in colorless needles, m. p. 117°. *2-i-Butylmercapto-6-oxypyrimidine*, prepared in similar manner from the pseudo-*i*-butylthiourea hydrobromide, crystallizes from 50 per cent. alcohol in leaf-like plates, m. p. 107°. *2-i-Amylmercapto-6-oxypyrimidine* crystallizes from 50 per cent. alcohol in long, thin plates, m. p. 115°. *Nitration of Uracil* (by S. H. Clapp).—Uracil was nitrated by a mixture of concentrated sulphuric and fuming nitric acids at 125°, and the nitrouracil reduced to aminouracil by aluminum amalgam in ammoniacal solution. The 5-*aminouracil picrate* crystallizes from water in yellow rectangular plates, which begin to sinter strongly at 150°, and melt with effervescence at 247-248°. By the *nitration of 2-ethylmercapto-6-oxypyrimidine, of 2-thio-6-oxypyrimidine, and of 2-ethylmercapto-6-chlorpyrimidine* (by T. B. Johnson), 5-nitrouracil was obtained. 2,6-*Dichlor-5-brompyrimidine* (Formula II), from 5-bromuracil, phosphorus pentachloride and oxychloride, is an oil which boils at 119-120° at 17-18 mm., and in a freezing-mixture solidifies to a crystalline mass, m. p. —3° to —2°. 2,6-*Dianilino-5-brompyrimidine* (Formula III), from the foregoing and aniline, crystallizes from alcohol in colorless needles, m. p., 191°. 2-*Anilino-5-brom-6-oxypyrimidine* (Formula V), from 2-ethylmercapto-5-brom-6-oxypyrimidine and aniline, crystallizes from alcohol in colorless needle-like prisms, melting with effervescence at 246°. 2-*Anilino-5-brom-6-chlorpyrimidine* (Formula VI), from the last compound and phosphorus oxychloride, crystallizes from ligroin in bunches of long, radiating, colorless needles, m. p. 106-107°. Warmed with aniline on the water-bath, it gave the 2,6-dianilino-5-brompyrimidine described above. 2-*Ethylmercapto-4-ethyl-6-oxypyrimidine*, from pseudoethylthiourea hydrobromide, alkali, and ethyl propionylacetate, $C_2H_5COCH_2COOC_2H_5$, crystallizes from alcohol in large, stout, transparent prisms, m. p. 89°. 2-*Ethylmercapto-4-ethyl-5-brom-6-oxypyrimidine*, obtained by brominating the last compound in glacial acetic acid solution, crystallizes from alcohol in large, stout, colorless, transparent prisms, m. p. 172-173.5°. 4-*Ethyluracil* resulted when this mercaptobrompyrimidine was evaporated to dryness with strong hydrochloric acid. It crystallizes from alcohol in beautiful, colorless tables or blocks, m. p. 204°. The same product was obtained by boiling 2-ethylmercapto-4-ethyl-6-oxypyrimidine with hydrochloric acid. Bromination of this 4-ethyluracil, gave 4-*ethyl-5-bromuracil*, which crystallizes from alcohol in plates or wisps, from water in snowy prisms, m. p. 230-231°. 2-*Methyl-*

*mercapto-6-oxypyrimidine hydrochloride* was obtained on passing chlorine into a glacial acetic acid solution of the mercaptooxypyrimidine. It crystallizes from glacial acetic acid in prismatic plates, which melt with vigorous effervescence at 189°. Boiled with hydrochloric acid, uracil is formed. Warmed with phosphorus pentachloride and oxychloride, *2-methylmercapto-6-chlorpyrimidine* is formed. The latter is a colorless oil, b. p. 139-140° at 36 mm., which solidifies in a freezing-mixture, and melts at —2° to 0°. *2-Methylmercapto-6-aminopyrimidine*, from the above chlorpyrimidine and concentrated alcoholic ammonia at 120-130°, crystallizes from benzene in large, colorless, diamond-shaped, prismatic plates, m. p. 125-126°. M. T. BOGERT.

**Researches on Pyrimidines: The Action of Potassium Thiocyanate upon Some Imide Chlorides (Ninth Paper).**—BY HENRY L. WHEELER AND H. STANLEY BRISTOL. *Am. Chem. J.*, 33, 448-460.—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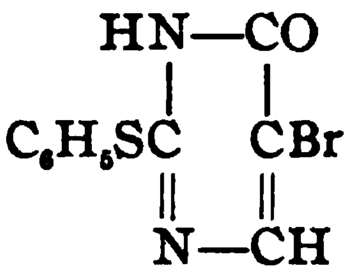
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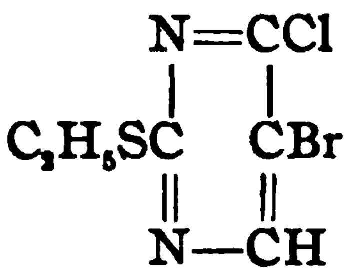
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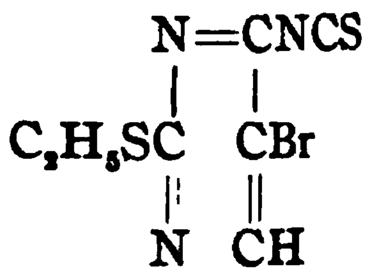
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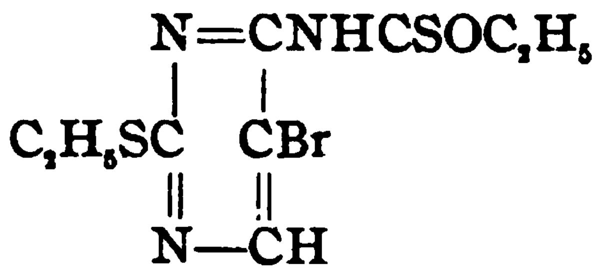
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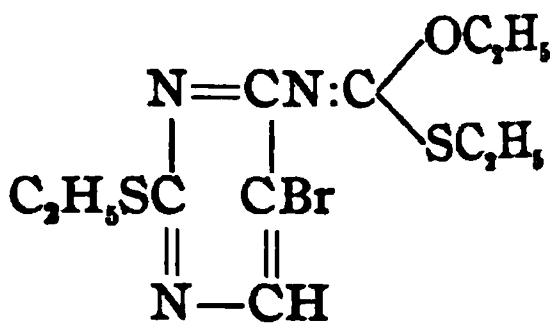
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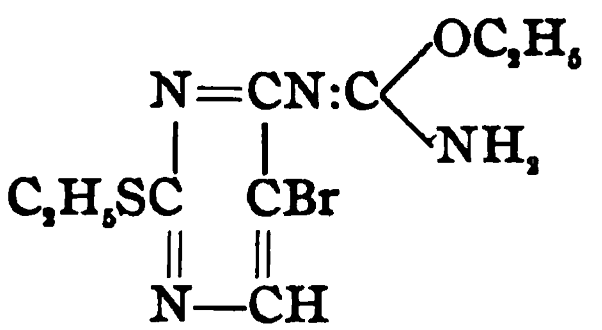
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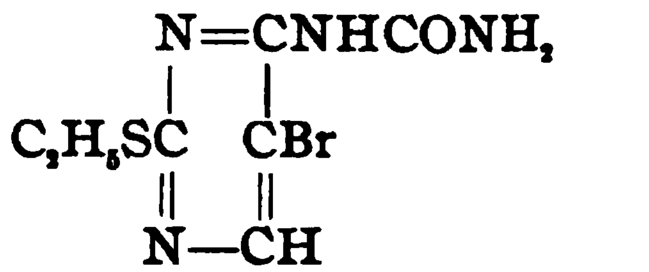
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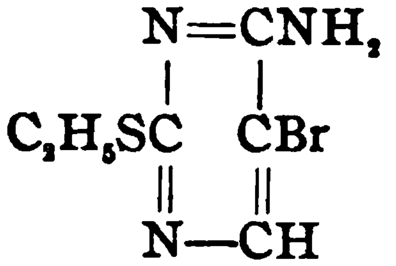
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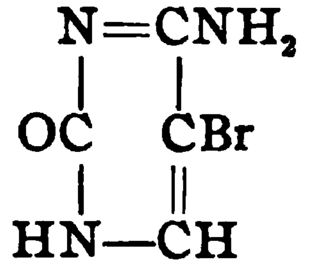
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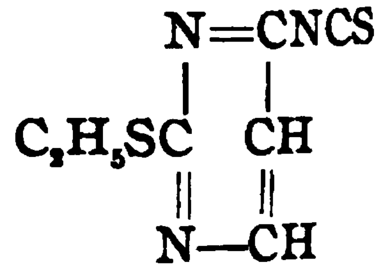
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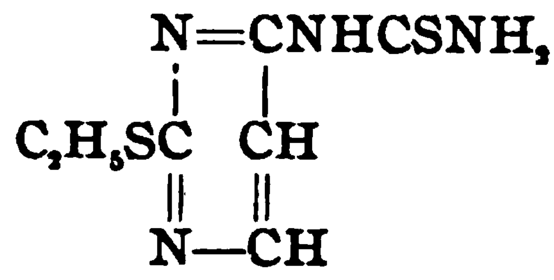

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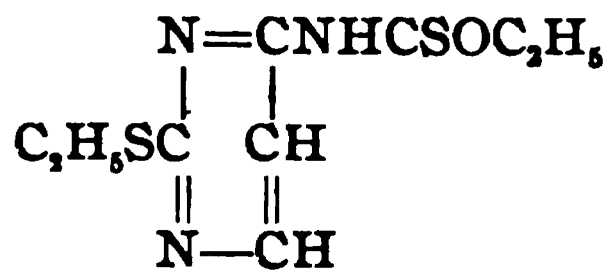

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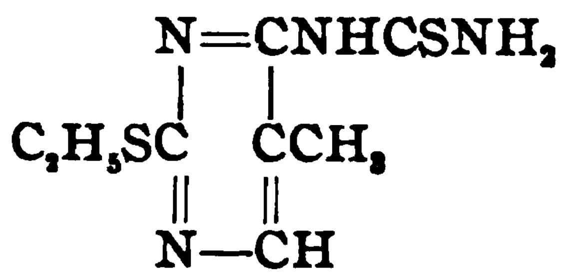

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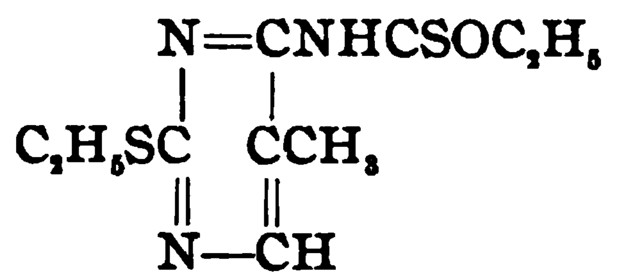

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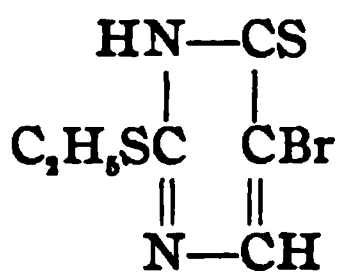

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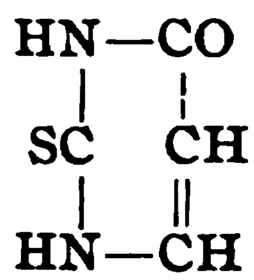

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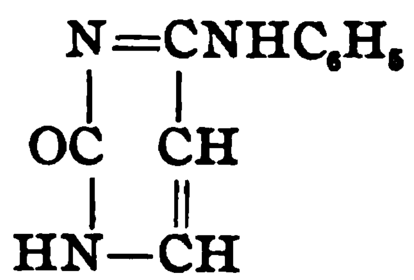

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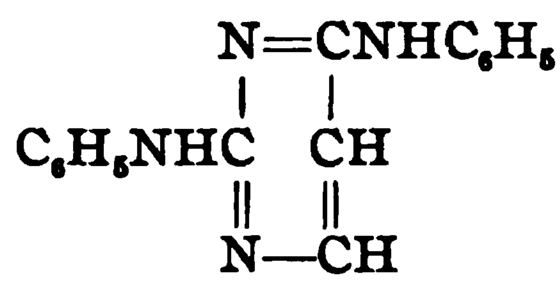

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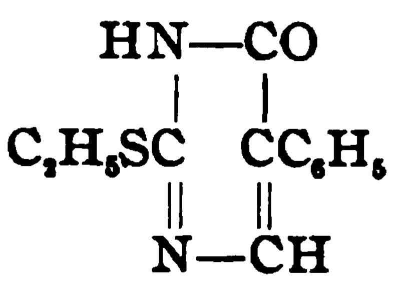
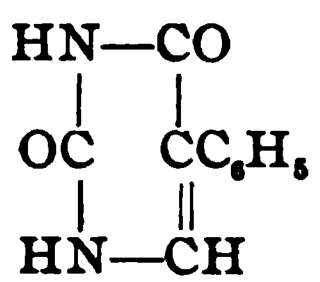


XX.



XXI.

The similarity in structure between the imide chlorides and the chlorpyrimidines, suggested to the authors the idea of examining the behavior of these pyrimidines with potassium thiocyanate. Since the imide chlorides are more closely related to the acyl than to the alkyl halides, it was expected that isothiocyanates would thus be obtained, and it was found that the action of potassium thiocyanate upon chlorpyrimidines does actually result in the formation of isothiocyanpyrimidines. Thus, 2-ethylmercapto-6-oxypyrimidine (I) was brominated (II), changed to the chloride (III), and the latter boiled with potassium thiocyanate in toluene solution, giving the isothiocyan derivative (IV). This gives the corresponding thiourea derivatives with ammonia, aniline, etc. When the chlor compound (III) was boiled with potassium thiocyanate in *alcoholic* solution, the thionurethane (V) was obtained, from which the imidothiocarbonate (VI) was prepared by the action of ethyl bromide and sodium ethylate. Alcoholic ammonia changed the latter to the pseudourea (VII), which gave the normal urea (VIII) when treated with cold con-

centrated hydrochloric acid. Boiling hydrochloric acid changed the normal urea to 5-bromcytosine (X). Attempts to condense the pseudourea or the normal urea to purine derivatives failed. The bromine in these compounds is very firmly bound, but the urea and pseudourea groups are easily removed. When the pseudourea (VII) was heated with pyridine or aqueous ammonia, in a sealed tube, or when it was boiled with formic acid, 2-ethylmercapto-5-brom-6-aminopyrimidine (IX) was obtained. The same product resulted when the normal urea (VIII) was heated above its melting-point. Sodium, acting upon a boiling benzene solution of the pseudourea (VII), failed to remove the bromine, but attacked the pseudourea grouping. Some new uracil and cytosine derivatives are described. EXPERIMENTAL.—*2-Ethylmercapto-6-isothiocyanpyrimidine* (XI), from 2-ethylmercapto-6-chlorpyrimidine and potassium thiocyanate in toluene solution, crystallizes from benzene in small, light-yellow, prismatic plates, m. p. 175°, b. p. about 180° at 32 mm. The addition of concentrated aqueous ammonia to its toluene solution, results in the formation of *2-ethylmercapto-6-thioureapyrimidine* (XII), long, thin, colorless prisms (from alcohol), m. p. 214°, difficultly soluble in water. *2-Ethylmercapto-6-phenylthioureapyrimidine*, prepared in similar manner, using aniline instead of ammonia, crystallizes from alcohol in long, colorless needles, m. p. 205°. *2-Ethylmercapto-6-thionurethanepyrimidine* (XIII), from 2-ethylmercapto-6-chlorpyrimidine and potassium thiocyanate, in alcoholic solution, crystallizes from alcohol in long, thin light-yellow, etched plates, m. p. 93°. Boiled with concentrated hydrochloric acid, it yielded a mixture of about equal parts of uracil and cytosine. *2-Ethylmercapto-5-methyl-6-thioureapyrimidine* (XIV), from the corresponding chlorine derivative and potassium thiocyanate, in toluene solution, with subsequent addition of alcoholic ammonia, crystallizes from benzene in needles, m. p. 192°. *2-Ethylmercapto-5-methyl-6-thionurethanepyrimidine* (XV), from the chloride, potassium thiocyanate and alcohol, when dissolved in benzene and reprecipitated with ligroin, separates in groups of pale-yellow prisms, m. p. 88-89°. *2-Ethylmercapto-5-brom-6-isothiocyanpyrimidine* (IV), from the chloride (b. p. 168° at 24 mm.-25 mm., 179-180° at 36 mm.) and potassium thiocyanate, in toluene solution, was obtained in pale-yellow prisms, m. p. 79-80°, by dissolving the crude material in toluene and adding a small amount of petroleum ether. *2-Ethylmercapto-5-brom-6-thioureapyrimidine* crystallizes from benzene in light-yellow plates, m. p. 220°. *2-Ethylmercapto-5-brom-6-phenylthioureapyrimidine*, fine, colorless needles, m. p. 166-167°. *2-Ethylmercapto-5-brom-6-thionurethanepyrimidine* (V), from the chloride and potassium thiocyanate, in alcoholic solution, forms long, pointed, light-yellow, prismatic plates, m. p. 82°. There were formed at the same time both 2-ethylmercapto-5-brom-6-

aminopyrimidine and *2-ethylmercapto-5-brom-6-thiopyrimidine* (XVI). The latter was separated from the above urethane by its insolubility in cold benzene. It crystallizes from hot benzene in pale-yellow, pointed, etched plates, melting with slight effervescence at 198°. It may also be prepared by the action of potassium hydrogen sulphide upon the corresponding chloride. *2-Ethylmercapto-5-brom-6-iminothioethylcarbonatepyrimidine* (VI), from the above thionurethane, sodium ethylate and ethyl bromide, crystallizes from alcohol containing a little water in long, colorless prisms, m. p. 43°. *2-Ethylmercapto-5-brom-6-pseudoethylureapyrimidine* (VII) was obtained in quantitative yield by passing ammonia gas into an alcoholic solution of the foregoing compound. It crystallizes from alcohol in beautiful, long needles, m. p. 110°. Heated with pyridine or with concentrated aqueous ammonia in sealed tubes, or boiled with formic acid, 2-ethylmercapto-5-brom-6-aminopyrimidine was obtained. When the pseudourea was warmed for a short time with concentrated hydrochloric acid, the hydrochloride of this base was obtained. The action of sodium upon the benzene solution of the pseudourea failed to remove any bromine, but gave a compound which effervesced at 310°, and which was probably *2-ethylmercapto-5-brom-6-cyanamidepyrimidine*, since, when warmed with dilute hydrochloric acid, it yielded *2-ethylmercapto-5-brom-6-ureapyrimidine* (VIII). The latter was also produced by the action of cold concentrated hydrochloric acid upon the pseudourea. It crystallizes from alcohol in short, pointed plates, or stout prisms, m. p. 167°. Heated above its melting-point (at 170-188°), it changes to 2-ethylmercapto-5-brom-6-aminopyrimidine, but when boiled with concentrated hydrochloric acid yields 5-bromcytosine. *2-Thiouracil* (XVII).—Ethyl sodium formylacetate and thiourea were heated together in concentrated aqueous solution, the solution cooled and precipitated with acetic acid. The thiouracil thus obtained crystallizes from alcohol or water in colorless prisms, effervescing above 300°. *2-Ethylmercapto-6-anilinopyrimidine hydrochloride*, from 2-ethylmercapto-6-chlorpyrimidine and aniline, crystallizes in colorless needles or prisms, melting with effervescence at 198°. The *free base* forms fine colorless needles, m. p. 68°. *2-Oxy-6-anilinopyrimidine* (*Phenylcytosine*) (XVIII).—The *hydrochloride* of this base was obtained by boiling the above hydrochloride with strong hydrochloric acid. It crystallizes from alcohol or water in colorless needles or prisms, effervescing at 228°. The *free base* crystallizes from alcohol in beautiful, colorless, six-sided plates, m. p. about 269°. Its *chlorplatinate* forms yellow prisms, which contain one molecule of water of crystallization. *2,6-Dianilinopyrimidine* (XIX).—The *hydrochloride* was prepared by heating 2-ethylmercapto-6-chlorpyrimidine to 150° with two molecules of aniline. It crystallizes from alcohol in arborescent needles, m. p. 197°.

The *free base* crystallizes from alcohol in six-sided plates, m. p. 136–137°. *2-Ethylmercapto-5-phenyluracil* (XX) was obtained by condensing sodium phenylformylethylacetate with the ethyl iodide addition-product of thiourea in alkaline solution. It crystallizes from alcohol in long, needle-like prisms, m. p. 158°. *5-Phenyluracil* (XXI) resulted when the above compound was digested with concentrated hydrochloric acid on the steam-bath. It separates from hot alcohol or water in a flocculent mass of what appear to be microscopic plates, and does not melt at 350°.

M. T. BOGERT.

**Note on the Preparation of Certain Amines.** BY LATHAM CLARKE. *Am. Chem. J.*, 33, 496–500.—Dimethyltoluidines may be conveniently obtained in large yield by boiling the toluidine with considerable excess of methyl iodide, distilling off the excess of methyl iodide, liberating the methylated toluidine from its hydriodide by the action of alkali, and treating it again with methyl iodide. The author prepared *methylisoamylamine* and *dimethylisoamylamine*. Both are clear, colorless liquids, the former boiling at 95°, the latter at 98°. Other dialkylamines were prepared by the above method. In the case of the naphthylamines, the results were unsatisfactory, as these amines do not add methyl iodide readily.

M. T. BOGERT.

**A Card Index Stock List for Use in University Departments of Organic Chemistry.** BY MARSTON TAYLOR BOGERT. *Science, N. S.*, 21, 750–752.—A description of the stock list in use in the organic laboratory of Columbia University.

M. T. BOGERT.

**On a Ptomaine Extracted from the Putrefying Stomach and Stomach Contents of a Dog.** BY F. A. NORTON. *Am. J. Pharm.*, 77, 206–209.—The stomach of a dog which had been poisoned by strychnine was kept in a sealed Mason jar for six months, and then examined by the Stas-Otto method. In addition to the strychnine, a brown resinous basic compound, of alkaloidal character and marked physiological action, was found, formed probably as a result of putrefactive action. This base was found in the acid and alkaline ether extracts, in the alkaline chloroform extract, and in large amount in the alkaline amyl alcohol extract. This ptomaine has an intensely bitter taste and a strong disagreeable odor. It dissolves readily in water to a golden-yellow solution of slightly alkaline reaction. On concentrating the aqueous solution, yellow oily globules first appeared, from which some needle-shaped crystals later separated. The aqueous solution, acidified with a drop of hydrochloric acid and concentrated, gave radiating clusters of needles. The physiological effect of the compound was determined upon a frog. Its action was found to be powerful, 0.02 gram causing the death

of the frog in an hour. The chemical behavior of the ptomaine was tested with the following reagents: Phosphotungstic acid, picric acid, tannic acid, potassium mercuric iodide, gold chloride, platinum chloride, mercuric chloride, iodine in potassium iodide, ferric chloride and potassium ferricyanide, potassium pyrochromate in concentrated sulphuric acid, Fröhde's reagent, chlorine water, sulphuric acid, nitric acid, and hydrochloric acid.

M. T. BOGERT.

## BIOLOGICAL CHEMISTRY.

**The Influence of Alkaloids and Alkaloidal Salts upon Catalysis.** BY ORVILLE H. BROWN AND C. HUGH NEILSON. *Am. J. Physiol.*, 13, 427–436.—The salts of hydrochloric, hydrobromic, and nitric acids, whether the base is an alkaloid or a metal, invariably have a retarding effect upon the catalysis (peroxide of hydrogen by platinum black and various animal extracts). The sulphate of the metal and the hydrosulphate of the alkaloid are uniformly ineffective except in concentrated solutions, where there is depression in case of the metal. The sodium salt of phosphoric acid stimulates considerably, while the alkaloidal salt is comparatively inactive. This is probably due to the fact that the sodium phosphate is alkaline in reaction, even in the concentrations used. The salts of acetic, valerianic, and citric acids, both metallic and alkaloidal, invariably increase the amount of the catalysis. The alkaloidal salts are active in much greater dilutions than the metallic salts, and the alkaloidal salts are less effective upon the catalysis by platinum black than upon that by organ extracts.

F. P. UNDERHILL.

**Note on the Preparation of Nucleic Acid.** BY HENRY B. SLADE. *Am. J. Physiol.*, 13, 464–465.—A modification of the method for the preparation of nucleic acid, in which magnesium sulphate is substituted for hydrochloric acid and alcohol.

F. P. UNDERHILL.

**Contribution to Our Knowledge of the Action of Pepsin, with Special Reference to Its Quantitative Estimation.** BY PERCY W. COBB. *Am. J. Physiol.*, 13, 448–464.—With regard to the quantitative methods of Mett it is shown that with a tube of 2.5 to 3 mm. bore, digestion is not retarded by the depth of the tube *per se* at depths of less than 7 mm. With such tubes, using 10 cc. of test solution containing 0.2 per cent. hydrochloric acid, a definite decrease in the column digested results from an increase in the number of tubes. Making all due allowance for errors due to the method itself, pepsin solutions capable of digesting 4 mm. or over in twenty-four hours give results far below those anticipated

by the rule of square roots from the amount of pepsin present. No calculation can be made in any case as to the absolute or relative pepsin values until the question of inhibition is eliminated. Commercial pepsin sometimes contains considerable amounts of inhibitory substance, evident in solutions of 1/64 per cent. strength. Results obtained by the albumin-froth method of Bettman and Schroeder cannot be justifiably expressed in figures indicative of pepsin concentration, but only by such expressions as "strong," "very strong," "moderate," etc.

F. P. UNDERHILL.

**The Precipitation Limits with Ammonium Sulphate of Some Vegetable Proteins (Second Paper).**—BY THOMAS B. OSBORNE AND ISAAC F. HARRIS. *Am. J. Physiol.*, **13**, 436–448.—Hofmeister's method of fractional precipitation of proteins from their solutions by ammonium sulphate affords, in most cases, a valuable and ready means for the separation of such substances when associated in the same solution. The precipitation limits are not characteristic for each individual protein substance, as is commonly assumed, but appear to depend on the conditions existing in the solution at the time of precipitation. In several experiments the two products obtained, the one by precipitating a large part of the dissolved protein at a definite degree of saturation, and the other obtained from its filtrate at one-tenth higher saturation, after separation from solution by dialysis, were found to have the same limits of precipitation as one another, which limits were lower and wider apart than those between which the separation was first made. The products were also alike in composition and properties. Vegetable globulins cannot be distinguished from vegetable albumins by means of their precipitation limits with ammonium sulphate, since many of these globulins are not precipitated until the concentration in ammonium sulphate is raised well above one-half saturation, while leucosin, the best characterized albumin of vegetable origin now known, is almost completely precipitated at one-half saturation.

F. P. UNDERHILL.

**The Physiological Behavior of Methylene Blue and Methylene Azure: A Contribution to the Study of the Oxidation and Reduction Processes in the Animal Organism.** BY FRANK P. UNDERHILL AND OLIVER E. CLOSSON. *Am. J. Physiol.*, **13**, 358.—The evidence offered of a conjugate body formed in the organism after the introduction of methylene blue is insufficient (see Herter: *Am. J. Physiol.*, **12**, 128 and 207). The experimental facts of Herter can be accounted for by the presence in significant quantities of two chromogenic substances, leuco-compounds corresponding to methylene blue and methylene azure. The introduction of methylene blue, whether intravenously, intraperitoneally, or by way of the mouth, is followed by the ap-

pearance in the urine and feces of methylene blue, methylene azure—an oxidation product of methylene blue—as well as leuco-compounds corresponding to methylene blue and methylene azure. When pure methylene azure is injected, intravenously or intraperitoneally, only a portion of the dye can be regained, consisting of methylene azure and a leuco-compound of this dye. Small doses of either methylene blue or methylene azure fail to reappear in the urine. It is only when the oxidative processes of the organism are inadequate that these bodies are manifested. The present experiments therefore demonstrate the simultaneous action of both oxidation and reduction processes in the animal organism. F. P. UNDERHILL.

**The Effect of Intestinal Antisepsis on the Excretion of Hippuric Acid in the Urine.** BY JACOB B. PRAGER. *Med. News*, **86**, 1025–1027.—When putrefactive changes are increased in the intestine of the dog there is an increased excretion of hippuric acid, and when the intestine was made antiseptic with calomel practically no hippuric acid was excreted. Intestinal antisepsis has no effect whatever upon the nitrogen excretion. It was further shown that the feeding of gelatine alone increases the elimination of hippuric acid. No matter how much gelatine was fed it was completely burned and some of the body's proteid with it. Therefore gelatine never builds up any tissue, although it may, to a certain extent, protect the body's proteid from decomposition. F. P. UNDERHILL.

**The Detection of Minute Traces of Sugar in the Urine.** BY ERNEST L. MCEWEN. *Am. J. Med. Sci.*, **129**, 1065–1070.—Two forms of crystals may appear in urine after treatment with phenylhydrazine, one composed of slender needles arranged in the form of sheaves and half-sheaves and is typical of sugar; the other, much smaller, composed of radiating speculae aggregated into spinous masses, has been variously interpreted. Glycuronic acid in urine produces a crystal very similar to the true sugar crystal. Its component filaments are very slender, and are never short and thick, as may be the case in the thorn apple crystal. Glycuronic acid crystals cannot be removed by previous fermentation with yeast. The thorn apple crystal appears in a very large proportion of all urines examined, and increases in number as low percentages of sugar are added to urine normally showing them. A point is ultimately reached in this addition where typical crystals appear. Both the typical crystal and the thorn apple crystal can be removed by previous fermentation with yeast. It may therefore be concluded that the small "thorn apple" crystal indicates the presence of sugar, that practically all urines contain traces of sugar, and that the phenylhydrazine test will detect its presence. F. P. UNDERHILL.

**A Study of the Metabolism of a Vegetarian.** By John M. Swan. *Am. J. Med. Sci.*, **129**, 1059–1065.—By means of a vegetarian diet the subject ingested 9.3 grams of nitrogen daily; the excretion in the urine was 9.8 grams. The study of the patient showed that the diet was not calculated to produce a properly nourished and mentally and bodily active individual.

F. P. Underhill.

**On Proteolytic Enzymes.** By Arthur L. Dean. *Bot. Gazette*, **39**, 321–339.—In the experiments described in this article, evidence has been obtained of the presence of a protease in the leaves of the spinach and cabbage, the blossoming heads of *Daucus Carota* and the developing seeds of that plant, in the leaves and unripe seeds of the chestnut, the etiolated seedlings of *Phaseolus Minigo*, the seeds and seedlings of *Cucurbita maxima* and the seeds of *Cucurbita Pepo*. In the case of *Phaseolus vulgaris*, experiments with all stages of the germination of the seed have shown that the cotyledons always contain an enzyme of the erepsin group, and at no time can evidence be obtained of the presence of an enzyme capable of attacking the proteids of the seed. This ereptase may be removed from the bean extracts by half saturation with ammonium sulphate. On dissolving this precipitate in water and dialyzing the solution free from sulphates, the enzyme is obtained in a solution which is perfectly clear and gives but feeble reactions for proteids. A preparation of the enzyme may be obtained by drying this solution at a temperature below 50° C. The enzyme acts on the protoproteose, the heteroproteose, and the deuteroproteoses, separated from Witte's peptone, it is quite inactive on the phaseolin of the bean, excelsin of the Brazil nut, edestin of the hemp-seed, and boiled fibrin. There can be no doubt but that the large proteid store in bean seeds is utilized in germination, and in all probability this utilization is preceded by cleavage to the amino acid, hexone bases, etc.

F. P. Underhill.

**The Effects of Transposition of the Daily Routine on the Rhythm of Temperature Variation.** By Robert Banks Gibson. *Am. J. Med. Sci.*, **129**, 1048–1059.—The purpose of the paper is to show the cosmic influence upon the temperature variation. Such influence was determined by a trip around the world whereby the shifting of the daily routine so that day and night are practically reversed, occurs. Observations on the temperature variations show that transposition of the daily routine appears to produce a corresponding and coincident shifting of the rhythmic temperature changes, so that the normal character of the variations is always preserved.

F. P. Underhill.

**Recent Advances in Our Knowledge of the Chemical Processes of Digestion.** By Lafayette B. Mendel. *Med. News*, June 20, 1905.

F. P. Underhill.

**On the Influence of Copious Water-Drinking.** BY P. B. HAWK. *Univ. Penn. Med. Bull.*, March, 1905.—Copious water-drinking causes an increased excretion of nitrogen and phosphorus by the urine. The increase in the amount of nitrogen eliminated is due, primarily, to the washing-out of the tissues of the urea previously formed, but which has not been removed in the normal processes, and, secondarily, to a stimulation of proteid catabolism. The increase in the excretion of phosphorus is due to increased cellular activity and the accompanying catabolism of nucleins, lecithins, and other phosphorus-containing bodies. The course of the sulphur ($SO_3$) excretion, while somewhat irregular, still showed a general tendency to run parallel with that of nitrogen. There was a constant tendency for the largest percentage of the ingested fluid to be excreted by the urine on the days of copious water-drinking.

F. P. UNDERHILL.

**On the Distribution of Nitrogen in the Liver of the Sturgeon.** BY A. J. WAKEMAN. *Z. physiol. Chem.*, **44**, 341.—An analysis of the liver of the sturgeon showing the relation of the quantity of the hexone base nitrogen to the total nitrogen is given. It was found that of the total nitrogen 6.78 per cent. was in the form of arginine, 1.76 per cent. in the form of histidine and lysine was contained to the extent of 4.05 per cent. The method employed was that of Kossel and Patton (*Z. physiol. Chem.*, **38**, 39).

F. P. UNDERHILL.

**Chemical Changes of the Liver in Phosphorus Poisoning.** BY A. J. WAKEMAN. *Z. physiol. Chem.*, **44**, 335–341.—During phosphorus poisoning the liver substance is poorer in nitrogen (calculated by percentage). Under the influence of phosphorus poisoning the quantity of arginine, histidine and lysine is decreased. From these observations the conclusion is drawn that the portion of the proteid molecule richest in nitrogen is the most labile. The experiments were made on dogs.

F. P. UNDERHILL.

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## SANITARY CHEMISTRY.

**The Field Assay of Water.** BY M. O. LEIGHTON. *Eng. News*, **53**, 586–591.—A description of the field methods devised for the U. S. Geological Survey for determining turbidity, color, iron, chlorine, total hardness, alkalinity, normal and acid carbonates, sulphates and calcium. The reagents used are almost all in tablet form and the apparatus required is very small in amount and can be easily carried into remote mountain districts. Turbidity is determined by use of Hazen's turbidity rod; color, by the aluminum tube fitted with color disks for reproducing the

Hazen Platinum Cobalt scale; iron, by color—a modification of the ordinary potassium ferrocyanide method. The modification consists in using fixed color standards, each having been previously rated to correspond with some known equivalent of iron. These color standards may be red glass disks, rated and used precisely in the same way as natural color standards, or colored paper properly rated. The paper standards are far simpler to prepare and much less costly. According to the author, "the blood-red color of the standard solution can be exactly copied upon paper in an almost infinite variety of tints. The sheets are then bound in book form. Every alternate leaf should be a pure white. In making the determination one of the aluminum tubes is filled with water to be tested, properly treated with acid and potassium ferrocyanide, while the other should contain the distilled or colorless water. With the book lying open before the observer the tube containing the solution to be tested should be pointed toward the white leaf while that containing the colorless water is pointed toward the colored leaf. The positions of the tubes should be such that the eye can see through both at a glance. The pages should then be turned until the color in both tubes is alike. The rating of the colored sheet then gives the amount of iron in the water." Chlorine is determined by use of tablets containing known amounts of silver nitrate, corresponding approximately to either 1 or 10 mg. of chlorine, their exact value being determined when purchased. The determination is made by placing 100 cc. of the water to be tested into a glazed porcelain mortar (4 inches diameter) and adding 5 drops of potassium chromate. One silver nitrate tablet is then cut into quarters, using ordinary care to cut the quarters equally. Whole tablets are added to the water till near the end-point when quarter tablets are used. The end-point is the appearance of the red color of silver chromate. Practical tests of this method, results of which are given, show an error of only 2½ or 3 per cent. Total hardness is determined by using tablets of pure sodium oleate marked by the Geological Survey "F," "H," and "Q," corresponding to 1 mg., 0.5 mg., 0.25 mg. of calcium carbonate respectively. In using these tablets 100 cc. of the water are placed in a specially designed bottle with the heavy hemispherical bottom. Tablets are then added one at a time and dissolved in the water and the determination conducted in the same manner as when soap solution is used. The total alkalinity is determined by use of sodium acid sulphate tablets corresponding to 1.995 mg. calcium carbonate. In making the determination 100 cc. of the water to be tested are measured into a porcelain mortar and 2 drops of methyl orange indicator added. Sodium acid sulphate tablets are then added till an acid reaction is obtained, then an amount of the water to be tested till an alkaline reaction is again shown. When the water has a high alkalinity, the process is fairly accurate

as is shown by results which are given, but when the alkalinity is low and only a few tablets have to be used the error is too great, as is stated by the author, even for a field method, and in this case it is advisable to use a much larger amount of water than given above. The normal and acid carbonates are determined by a modification of Winkler's method. A convenient quantity of the water to be tested is measured into a porcelain mortar and 4 drops of phenolphthalein added, then sodium hydrogen sulphate tablets, till the color disappears, the number added being noted. Four drops of methyl orange indicator are then added to the solution and the titration with the tablets continued until the orange color of the solution changes to a faint pink. From the results so obtained the amount of normal and of acid carbonate can be calculated in the ordinary way. Sulphates are determined by the method devised by Mr. D. D. Jackson, which requires the use of Jackson's turbidimeter. It depends upon the amount of turbidity produced by adding a given amount of barium chloride to a given volume of water made acid with hydrochloric acid. From the readings of the turbidimeter and use of tables which are given, the amount of sulphate is obtained. Calcium is determined by a similar method, the water to be tested being made slightly alkaline with ammonia, and calcium oxalate crystals added. LEONARD P. KINNICUTT.

**Filtration of Public Water Supplies.** BY R. WINTHROP PRATT. Engineer Ohio State Board of Health, *Ohio Sanitary Bulletin,* 10, pp. 65–82.—The reasons or necessity for filtration. A description of slow sand and of mechanical filtration, operation and efficiency of filtration, cost of filtration, and future use of filtration plants. Water supplies require filtration when polluted by sewage or disease-producing germs, or when objectional for municipal use on account of color, odor, taste or mineral substance it contains. Small amounts of turbidity and odor which are caused by suspended matter may be removed equally well by either slow or mechanical filtration. For high turbidities and color caused by soluble matters, mechanical filtration is necessary. Odors and taste can frequently be removed by either method but sometimes their removal requires the use of chemicals, aeration or repeated filtration. The bacterial efficiency or percentage reduction under favorable conditions is 98 to 99 per cent., and slow sand filters have given even a higher percentage. A better test for efficiency is the removal of *Bacillus coli*, and properly constructed and operated filters have succeeded in entirely removing this bacillus. The true test of the efficiency of filtration is the reduction in the typhoid death-rate due to the introduction of filtered water. This is shown by the following examples: London from 98 to 14 per 100,000, or 95 per cent.; Berlin 111 to 11, 90 per cent.; Hamburg 47 to 7, 83

per cent.; Lawrence 120 to 26, 78 per cent.; Zurich 76 to 10, 87 per cent.; Lorain, Ohio, 91 to 19, 79 per cent.; Philadelphia estimated reduction of typhoid cases in certain wards during 1904, 70 per cent.; total average reduction, 70 per cent. Slow sand filters cost more to construct but usually less to operate. The slow sand filters at Albany, covered, capacity 15,000,000 gallons per day, cost about $400,000. The mechanical filter plant at Little Falls, New Jersey, nominal capacity 32,000,000 gallons daily, cost about $500,000. It is estimated that filtered water including interest charges and operating expenses costs from $6 to $10 per million gallons. At $10 per million gallons the cost to each inhabitant of a city where the daily consumption is 100 gallons per capita is 36½ cents per day, an increase in the water rate of only about 10 per cent. In 1880, according to Mr. Hazen, only 0.23 per cent. of the urban population of the United States living in towns of 2,500 or over were supplied with filtered water, while in 1904, 9.7 per cent. were thus supplied. The slow sand filtration is in use by about 560,000 people or 1.7 per cent. of the above urban population, while mechanical filters are used by 2,600,000 or 8 per cent. Considering the urban population living in cities of 25,000 or over, 19.3 per cent. live in cities where filters are in use or under construction, 21.4 per cent. in cities where filters have been officially recommended, 31.1 per cent. where filters should be built at once, 22.2 per cent. where filters will be needed in the future, leaving only 6 per cent. living in cities where the water will not require filtration.

LEONARD P. KINNICUTT.

**The Electrical Production of Ozone and Sterilization of Water by Ozone.** *Electrochem. Ind.*, 2, 511–512. A description of the Vosmaer's process of purification of ozone as used at Nieuwersluis on the River Vecht, Holland. The plant has a capacity of about 5,300 gallons per hour. The river water is passed through a roughing filter and thence to the top of a standpipe, 15 inches in diameter, and 35 feet tall, down which standpipe it flows, meeting in its downward flow a current of ozonized air. The air is ozonized, after being dried by passing through an iron tank in which are shelves containing calcium chloride, by passing through the ozonizer, an apparatus consisting of a number of light copper tubes, each about 3 inches in diameter and 16 feet in length, the tubes being supported at either end in headers in the manner of an ordinary closed feed-water heater, the air discharge pipe from the drying tank connecting with the header at one end of the ozonizer, and the air suction pipe to the air-pump with the opposite header of the ozonizer. The pump compresses the air to slightly above atmospheric pressure and delivers it in the bottom of the standpipe already referred to, in which it ascends, distributing itself in minute globules through the descending water.

From 1.5 to 2 grams of ozone per cubic meter of water pumped are used; one kilowatt-hour of electrical energy produces 15 grams of ozone; the quantity of ozonized air required for the ozonizing of the water is in proportion of about one and eight-tenths volumes of atmospheric air to one volume of water. When once started it is stated that the plant requires scarcely any attention. The only question of importance is the determination of the amount of ozone required for the particular water to be treated. There are two methods for determining whether the quantity of ozone supplied be sufficient or not. First, by testing the surplus of ozone at the outlet of tube of the standpipe, by iodide of starch paper. Second, by the sense of smell. As long as there is ozone left, it is certain that there has been sufficient to destroy the bacteria. According to Dr. Ohlmueller and Dr. Prall, of the German Imperial Board of Health, by the treatment of water with ozone a remarkable destruction of bacteria is produced, and in this regard ozonizing is, in general, superior to separation of bacteria by sand filtration. The cholera and typhus bacilli are destroyed. Viewed from a chemical point of view, the water is affected only in so far that the oxidizable matter is reduced and the free oxygen increased, both of which mean an improvement of the water. The ozone which is introduced in the water is of no importance from a technical or health-affecting consideration, as it readily changes into oxygen. An experimental plant, using the above method and treating 1,000,000 gallons of water per day, has been erected by the United States Water Improvement Co. on the Schuylkill, near Philadelphia. LEONARD P. KINNICUTT.

**The Use of Copper in the Purification of Water Supplies.** Report of a meeting held January 5th, by the Washington Academy of Science. *Science*, **21**, N. S., 1905, pp. 603–624.—The principal speakers at the meeting were Dr. George T. Moore, Dr. Henry Kraemer, Dr. Mary E. Pennington, Mr. Alfred M. Quick, Dr. Marlatt, Dr. H. W. Wiley, Mr. M. O. Leighton and Dr. A. D. Doty. Dr. George T. Moore, in opening the discussion, gave a brief history of the use of copper sulphate in the purification of water supplies, which presented in a condensed form the work which has been published in Bulletins 64 and 76, Department of Agriculture, Bureau of Plant Industry, and of which abstracts have appeared in this Journal, **26**, R 459-462 and **27**, R 353-356. Mr. Quick, Chief Engineer of the Baltimore Water Department, gave an account of what had been accomplished at Lake Clifton and Lake Montebello, the source of Baltimore Water Supplies, an account of which had previously been published in the *Engineering News*, **52**, 283-285, and abstracted for this Journal, **26** R 526. Dr. Henry Kraemer, of the Philadelphia College of Pharmacy, gave an account of his experiments with

metallic copper. Using pieces of copper foil, about 25 cm. square to each 2,000 cc. of water, he found that after eight hours the number of bacteria showed a reduction of from 85 to 95 per cent. The number of bacteria in the water before and after treatment with copper is, however, not given. In the experiments with *B. coli* and *B. typhosus*, pure cultures were used and water under three different conditions was employed, distilled water; filtered tap water, prepared by means of a Berkefield filter attached to a copper spigot; and tap water collected after being run through a copper spigot for five minutes. To 200 cc. samples of each of the above waters, after being sterilized at 110° in an autoclave for thirty minutes and contained in Erlenmeyer flasks, were added two 3 mm. loops of fresh bouillon cultures of typhoid and colon bacilli respectively. Twelve flasks were thus prepared, six containing typhoid and six colon bacilli. Into three of the flasks containing typhoid bacilli and into three of the flasks containing colon bacilli were placed corrugated copper strips 15 mm. wide and 18 cm. long. Plates were made from all twelve of the flasks at the end of four and eight hours, one, two, six, fourteen, twenty-one, twenty-eight, and fifty-three days. In the flasks containing distilled water, filtered water and tap water in which no copper strips had been placed, the colon bacilli increased in twenty-four hours from about 10,000 to 1,000,000 and then gradually decreased, 500,000 being the average number at the end of fifty-three days. In the distilled water and in the tap water, which contained no copper foil, the typhosus bacilli increased from about 3,000 to 200,000 in twenty-eight days. In all the three classes of water in which copper foil had been placed no coli or typhosus bacilli were found at the end of four hours, the number in the water at the beginning of the experiment varying in the different flasks in case of coli from 4,000 to 8,000 and in case of typhosus from 127 to 4,000. Also in the case of the water which had been filtered through a Berkefield filter attached to a copper spigot but into which no copper strip had been placed, no typhosus bacilli were found at the end of four hours, though it originally contained 4.750. This surprising result Dr. Kraemer attributes to the extremely small quantities of copper dissolved by the water in its slow passage through the copper spigot to which the filter was attached. As a result of all these experiments Dr. Berkefield draws the following conclusions: "The intestinal bacteria, like colon and typhoid, are completely destroyed by placing clean copper foil in the water containing them. The effects of colloidal copper and copper sulphate in the purification of drinking-water are in a quantitative sense much like filtration, only the organisms are completely destroyed. Pending the introduction of the copper treatment of water on a large scale the householder may avail himself of a method for the purification of drinking-water by the use of strips of copper

foil about three and a half inches square to each quart of water, this being allowed to stand over night, or from six to eight hours, at the ordinary temperature, and then drawn off or the copper strips removed." Dr. Mary E. Pennington gave an account of experiments she had made with copper plates charged with very low electric currents, less than 4 volts and 0.01 ampere, over which the water to be purified was allowed to flow. When the apparatus is arranged to simulate a reservoir with inlet and outlet and of such construction that the entering polluted water must come into intimate contact with several electrified copper surfaces, the reduction in the number of both typhoid and colon bacilli is very great almost immediately. When such an effluent has stood at room temperature for an hour it is practically sterile. The copper, too, which, when germ-free water is used, may be found in traces, is, apparently, entirely eliminated from water containing a large number of organisms. Dr. C. L. Marlatt gave an account of his experiments with copper sulphate on mosquito larvae and stated that the general results shown are "that newly hatched mosquito larvae are killed in comparatively pure water by practicable additions of copper sulphate, namely, between 1 to 100,000 and 1 to 5,000,000, the necessary strength varying with the purity of the water; that copper foil exerts a remarkable effect upon young larvae; that the very highest practicable strength, namely, 1 to 100,000, will check the development of half and two-thirds grown larvae, and cause their ultimate death; that nearly full-grown and full-grown larvae are induced to promptly pupate, and that in the pupal stage absolute immunity to copper salts is shown." Copper sulphate, however, loses its action very quickly in fecal water or water containing much earthy matter, and field tests in open ponds failed to show any special value for copper sulphate. It is possible, however, that in tropical climates where much of the drinking-water is left in cisterns it may have a distinct field of usefulness. Dr. H. Wiley, after citing the report of the Committee on Food Preservatives, presented to both Houses of the English Parliament in 1901 which recommended, "That the use of copper sulphate in the so-called greening of preserved foods be prohibited," and the findings of the International Congress of Hygiene and Demography which met in September, 1903, "That the employment of antiseptics should be prohibited in the preservation of alimentary substances," stated that careful physiological researches had shown that minute quantities of copper long ingested produced great disturbances, especially of the liver, and that his principal purpose of entering into the discussion was to say a word of caution against the use of chemical germicides and antiseptics which may themselves be sources of contamination. Mr. M. O. Leighton, U. S. Geological Survey, referred to one case where the first application of copper sulphate, not stating where, failed to destroy the anabaena, and

where although the second application was successful, it was followed by the appearance of the organism Chlamydomonas, existing apparently upon the anabaena débris, the result being far worse than that which existed previous to the first application of copper sulphate. He also referred to the difficulty of measuring the amount of water contained in reservoirs and ponds and how, therefore, too much or too little copper sulphate might easily be used, and that every time an insufficient amount is applied it would undoubtedly have the effect of raising the resistance of the algae to this germicide and there would come a time when it would be impossible to exterminate them without the addition of a prohibitive amount of the sulphate. Dr. A. H. Doty, Health Officer, port of New York, stated that as a result of his own investigations with sulphate of copper, he was convinced of its value in sanitation, particularly as a deodorant and for the clarification of water when used either alone or in combination with lime. So far as its germicidal value is concerned, he did not believe that at present we are in possession of sufficient data to present definite and satisfactory information on the subject. He was satisfied that Dr. Moore's suggestions as to the use of copper in small amounts for the destruction of algae, and for removing the offensive odor and taste which frequently occur in reservoirs, was safe, practical, economical and very effective, but he was unable to endorse the recommendations made by Dr. Moore as to the use of copper sulphate as a disinfectant in reservoirs presumed to contain pathogenic organisms, particularly the typhoid bacillus, and that our present knowledge did not justify us in depending upon it in outbreaks of typhoid fever to the extent recommended by Dr. Moore. Dr. Moore closed the discussion, dwelling principally on the toxic properties of copper and referred to experiments of Gallipe, Kobert, Lehmann, Bernatzik and Paull, as showing the harmlessness of small quantities of copper, and stated that there did not exist in this country or abroad an authentic case of copper-poisoning, that the Italian government now allows 100 mg. of copper sulphate per kilogram in preserving vegetables, and in France it is allowable to use salts of copper to any amount for preserving the green color of vegetables. LEONARD P. KINNICUTT.

**Sewage Disposal.** BY GEORGE A. JOHNSON, Engineer in charge of Sewage Testing Station, Columbus, Ohio, *Ohio Sanitary Bulletin*, **10**, pp. 23–45.—This paper opens with a statement of George W. Fuller before the International Congress, that of the urban population of the United States in 1900, amounting to about 28,000,000 people, 73 per cent. discharge into inland streams or lakes, 23 per cent. into the sea or tidal estuaries, and but about 4 per cent. are tributary to sewage purification works. The author after stating the reasons for sewage purification,

describes the various methods of sewage disposal.—Dilution, Broad Irrigation and Sewage Farming, Intermittent Sand Filtration, Contact Beds, Sprinkling Filters—and mentions briefly the methods used in the preparatory treatment of sewage, including Sedimentation, Chemical Precipitation, Roughing Filters, and Septic Tanks. As to disposal by dilution Mr. Hering's and also Mr. Goodnough's statement as regards the amount of dilution necessary are given, and also the statement that the objectional conditions are likely to arise when dilution is less than 1 to 16 according to Hering, and when less than 1 to 23 according to Goodnough, and that the estimated safe limit according to Hering is when the dilution is over 1 to 45 and according to Goodnough over 1 to 36. Regarding broad irrigation and sewage farming the number of cities using this method is steadily growing less, though there are still notable examples of this form of treatment abroad. Paris, four farms combined area 13,300 acres. Berlin, 19,000 acres or over 30 square miles. Nottingham, England, 1,950 acres. In America this method of sewage disposal is confined chiefly to the extreme western sections where the rainfall is comparatively small, and it is used for irrigation purposes. It is estimated that the amount of land required for this method of treatment is 1 acre per 100 persons. In connection with intermittent sand filtration the following interesting table is given.

EFFICIENCY OF INTERMITTENT SAND FILTRATION IN MASSACHUSETTS.

(Analytical Results = Averages 1900-3, inclusive.)

| City or town. | Estimated population connected to sewers at end of 1903. | Per acre of filt. surface. | | Character of filtering material. | Purification effected by albuminoid ammonia. | | |
|---|---|---|---|---|---|---|---|
| | | Population served. | Gals. sewage treated daily. | | Parts per million. | | Removed. Per cent. |
| | | | | | Sew. | Eff. | |
| Andover | 3,600 | 986 | 34,200 | Med. fine sand | 10.9 | 0.64 | 94.1 |
| Brockton | 25,000 | 1,164 | 40,900 | Coarse sand | 14.2 | 0.14 | 99.0 |
| Clinton | 10,000 | 426 | 33,400 | Coarse sand | 10.9 | 0.83 | 92.3 |
| Framingham | 7,500 | 377 | 32,800 | Fine sand | 11.3 | 0.23 | 98.0 |
| Marlborough | 10,000 | 900 | 98,200 | Med. fine sand | 8.0 | 0.56 | 93.0 |
| Natick | 4,000 | 360 | 51,000 | Med. fine sand | 3.3 | 0.26 | 92.0 |
| Spencer | 3,000 | 323 | 40,300 | Med. coarse sand | 5.6 | 0.16 | 97.1 |
| Westborough | 3,000 | 750 | 70,000 | Coarse sand | 5.8 | 0.78 | 86.5 |

Also the following tables in connection with contact beds and sprinkling filters:

EFFICIENCY OF CONTACT BEDS IN ENGLAND.

| Process and location of plant. | Time during which beds were at work. Years. | Depth of bed. Feet. | Amount of sewage treated per acre daily. U.S. gallons. | Percentage purification. By oxygen absorbed. | Percentage purification. By albuminoid ammonia. |
|---|---|---|---|---|---|
| Single Contact: | | | | | |
| Croydon ........ | 2 | 3.75 | 762,750 | 64 | 61 |
| Manchester ..... | 4.5 | 3.33 | 550,800 | 75 | 70 |
| Birmingham..... | 1 | 4.50 | 600,000 | 80 | 79 |
| Double Contact: | | | | | |
| Blackburn ...... | 2 | 5.50 | 720,000 | 75–80 | 97 |
| Burnley......... | 5 | 3.00 | 231,600 | 87 | 85 |
| Carlisle ......... | 2 | 4.00 | 1,086,840 | 71 | 61 |
| Leeds........... | 2 | 5–6 | 600,000 | 95 | 90 |
| Sheffield ........ | 3 | 5.00 | 1,200,000 | 87–90 | 92 |
| Sheffield ........ | 3 | 3.33 | 780,000 | 87–90 | 92 |

EFFICIENCY OF SPRINKLING FILTERS IN ENGLAND.

| Location. | Number of years beds were at work. | Depth of bed. Feet. | Rate of treatment per acre daily. U. S. gallons. | Percentage purification. By oxygen absorbed. | Percentage purification. By albuminoid ammonia. |
|---|---|---|---|---|---|
| Leeds............. | 3.5 | 9 | 1,200,000 | 95 | 90 |
| Accrington ....... | 3.0 | 8–9 | 2,323,000 | 90 | 91 |
| Birmingham....... | 0.5 | 5 | 1,200,000 | 86 | 88 |
| Hyde ............ | 3.0 | 9 | 2,513,000 | 86 | 90 |
| York ............. | 1.0 | 6.5 | 2,555,500 | 84 | 90 |
| Rochdale.......... | 2.5 | 9 | 2,323,000 | 84 | 84 |

In conclusion, an account of the Columbus Sewage Testing Station is given. An account of this station was published in the *Engineering News*, **52**, 359–361. Abstract this Journal **27**, R 48.

LEONARD P. KINNICUTT.

**The Medico-Legal Questions Arising in the Case of Patrick Convicted of the Murder of Rice by Alleged Inhalation of Chloroform.** BY CLARK BELL. *Medico-Legal Jour.*, **22**, 494–512. —At the trial of Patrick it was claimed that death was caused by inhalation of chloroform. The chloroform, about one and three-quarter ounces, being poured upon a sponge, the sponge was enclosed in a cone made by folding a towel, and the cone placed

on Patrick's face covering the mouth and nose. The condition of the lungs, when the autopsy was made, was claimed to be due to inhalation of the chloroform. Before the autopsy was made, however, the body had been embalmed by the arterial process, using a solution known as Felcan, containing formaldehyde. At the November meeting of the Medico-Legal Society an application was made by an officer of the society to submit the question, how far the condition of the lungs observed at the autopsy was a proof that chloroform had been administered before death, to a committee of the Society to be appointed by the president. The committee consisted of Dr. Grinnell, Chairman, Prof. Echels, University of Pennsylvania, W. H. Francis, Dr. Harold, Dr. Moran and Dr. Sillo. The committee made a very careful study of the subject and reported that though the embalming liquid could not produce a congestion of the lungs or any part of the body, because a true congestion is a condition only found as a result of disease or injury occurring in a living person, yet the condition of the lungs after embalming is so like a true congestion that the difference between the two could only be told by a microscopical or bacteriological examination. It would be impossible for any one to discriminate from the post-mortem appearance of the lungs between the administration of chloroform as a means of death, or as the result of the embalming process. No one could truthfully have stated that death was wholly caused by the inhalation of chloroform from appearances as presented at the autopsy, because of the presence of embalming fluid, and further, because chloroform was not found by chemical tests. The committee also agreed, after carefully analyzing all the medical and other evidence furnished upon this case, that Mr. Rice did not die from chloroform poisoning, and furthermore, that no chloroform was administered to Mr. Rice while the said Rice was living, because it would have been impossible for the towel cone containing chloroform to remain unsupported upon the face of Rice, while asleep. It is also the opinion of the committee, without exception, that no chloroform was ever administered to Rice, as stated, because it would have been impossible not to have detected the odor of chloroform either in the room occupied by the deceased or from the body, as the amount of chloroform employed, as alleged, would have saturated the beard of deceased and this would have retained the odor for many hours, however thoroughly the apartments may have been ventilated. The testimony, that a lighted match applied to the towel containing about two ounces of chloroform, was followed by a "burning up quickly like oil," is absurd, because in an experiment performed by us in like manner, it required over fifty minutes to consume the towel. LEONARD P. KINNICUTT.

## AGRICULTURAL CHEMISTRY.

**Analysis of Food.** By Julius Hortvet. *Tenth Biennial Report of the Minnesota State Dairy and Food Commissioner* for the two years ending July 1st, 1904. The report gives in brief the results of the examination of 11,884 samples of foods of which 3,756 failed to comply with the requirements of the Minnesota law. The requirements of this state regarding some classes of foods are unusually strict. The sale of foods containing aniline dyes and chemical preservatives is prohibited. Notwithstanding this fact, however, a very large proportion of the foods found illegal were so declared because of improper branding.

The following table is given of the results of the laboratory.

| Articles. | Total. | Legal. | Illegal. |
|---|---|---|---|
| Alcoholic liquors | 2,145 | 1,003 | 1,142 |
| Baking-powder | 157 | 47 | 111 |
| Butter | 130 | 102 | 28 |
| Catsup | 73 | 38 | 35 |
| Cheese | 57 | 41 | 16 |
| Cider | 119 | 53 | 66 |
| Cream of tartar | 72 | 46 | 26 |
| Flavoring extracts | 699 | 569 | 130 |
| Fruit juices | 108 | 44 | 64 |
| Honey | 163 | 145 | 18 |
| Jellies, jams and preserves | 470 | 245 | 225 |
| Lard and lard substitutes | 833 | 767 | 66 |
| Linseed oil | 369 | 278 | 91 |
| Maple syrup and maple sugar | 413 | 124 | 289 |
| Meats | 57 | 45 | 12 |
| Milk and cream | 567 | 101 | 466 |
| Miscellaneous | 264 | 224 | 40 |
| Molasses and syrups (miscellaneous) | 91 | 51 | 40 |
| Oils (miscellaneous) | 54 | 48 | 6 |
| Soda fountain syrups and beverages | 583 | 393 | 190 |
| Spices | 3,177 | 2,767 | 410 |
| Vinegar | 1,283 | 998 | 285 |
| Total | 11,884 | 8,128 | 3,756 |

W. D. Bigelow.

**Food Products.** *Part II, Rept. Conn. Agr. Expt. Sta., 1904.*—This report includes analyses of some 300 samples of milk sold by milk dealers, showing that 8.9 per cent. of the samples were adulterated by watering or skimming or by the addition of dyes or preservatives. One hundred and eight samples were below the standard (12 per cent.) for solids; 31 below the standard (3.25 per cent.) for fat; and 185 below the standard (8.5 per cent.) for solids-not-fat. Only one sample of cream out of the 18 tested, was adulterated; the per cent. of fat varied from 18.4 to

47.6. Methods for the analysis of condensed milk are given. The report states that the common form of adulterating this article of food is the use of skim milk, there being no incentive for adding any preservatives, as the product is sterilized before sealing and furthermore contains much sugar which prevents fermentation. Twenty-eight brands are reported. Twenty-two samples of noodles were analyzed, the color in each sample being either turmeric or an azo-dye. Only three samples contained enough lecithin-phosphoric acid to indicate the use of egg yolk as coloring-matter. The methods of analysis are given. Of the buckwheat flours analyzed, 28 per cent. were found adulterated. Three samples of gluten flour contained from 10.8 to 54.3 per cent. protein. J. A. LeClerc.

**Analyses of Cottonseed Meal.** *S. C. Expt. Sta. Bull. 105.*

**Commercial Feeding Stuffs.** *Vt. Agr. Expt. Sta. Bull. 110; Ont. Dept. Agr. Bull. 138; N. J. Agr. Expt. Sta. Bull. 185.*

**Feeding Stuffs.** *N. Y. Agr. Expt. Sta. Bull. 255.*

J. A. LeClerc.

**Condimental, Tonic and Other Stock Foods.** *Penn. Agr. Expt. Sta. Bull. 70; N. J. Agr. Expt. Sta. Bull. 184.*

J. A. LeClerc.

**Feeding Stuff Inspection and Cottonseed Meal.** By J. M. Bartlett. *Me. Expt. Sta. Bull. 115.*—This bulletin gives analyses of the ordinary feeding-stuffs found on the Maine market, besides a comparative analysis of low- and high-grade cottonseed meal, and characteristics and digestibility of each.

J. A. LeClerc.

**Native and Introduced Saltbushes.** By Elias Nelson. *Wyo. Expt. Sta. Bull. 63.*—This bulletin gives the characteristics of salt-bushes and describes the various specimens grown in Wyoming, and the method of cultivation. No data bearing on the digestibility and nutritive value are given; it is believed, however, that they are not equal to the native grasses or the common forage crops grown in the state. J. A. LeClerc.

**Heavy and Light Weight Grains. Starchy and Glutinous Grains. Milling Tests of Wheat. Light and Dark Colored Flaxseed. Rusted Wheats.** By Harry Snyder. *Minn. Agr. Expt. Sta. Bull. 90.*—This bulletin gives results of chemical analyses of light and heavy samples of the same variety of wheat, oats, and barley, showing that the light weight grains contain a greater per cent. of protein, phosphoric acid, and potash but that the heavy-weight grains contain a larger total amount of these substances and are therefore preferable for seed and com-

mercial purposes. The heavy-weight wheat yields a larger amount, proportionally, of the commercial grades of flour. From results obtained it is found impossible "to determine the commercial value of a cereal either for food or for seed purposes on the basis of nitrogen content alone." The glutinous wheat kernels are darker colored, harder and have a more flinty texture than the starchy kernels, the former containing as much as 1.6 to 4.9 per cent. more protein. Starchy and glutinous rye and oats may also be distinguished the same as wheat. Concerning light and dark-colored flaxseed, no appreciable difference exists in the oil content, amount of protein and per cent. of ash. In the study of rusted wheat, the "intensity of the rust is almost proportional to the excess of protein remaining in the straw"—the straw of rusted wheat containing about twice as much protein as does normal straw. The rusted wheat itself is generally richer in protein. The remainder of the bulletin treats of the methods employed in determining the milling and bread-making value of wheats.
J. A. LeClerc.

**Fertilizers.** *Cal. Agr. Expt. Sta. Bull. 157.* F. P. Veitch.

**Fertilizers.** *Conn. Agr. Expt. Sta. Report, 1904, Part I.* F. P. Veitch.

**Analyses of Nicarauguan Woods and Barks.** By Dr. Louis E. Levi and J. Fred Sigel. *Hide and Leather*, **19** (1905), No. 23, p. 34.—

| | Bark. | | Wood. | |
|---|---|---|---|---|
| Variety. | Non-tannin. | Tannin. | Non-tannin. | Tannin. |
| Roble | 8.18 | 3.40 | 2.36 | 1.34 |
| Laurel Macho | ...... | ...... | 1.74 | 0.34 |
| San Cilbestre | 32.99 | 5.87 | 4.98 | 0.94 |
| Jacote Ismoyo | 4.60 | 4.98 | 6.33 | 3.19 |
| Cangre Drago | 3.33 | 7.76 | 3.11 | 1.23 |
| Copal | 4.57 | 2.97 | 3.70 | 1.78 |
| Gullisimo | 4.12 | 3.48 | 1.38 | 0.93 |
| Muneco | 9.45 | 4.84 | 5.19 | 1.85 |
| Fagua | 12.98 | 3.79 | 3.90 | 1.44 |
| Palo de Maria | 5.25 | 5.23 | 6.98 | 0.76 |
| Pato Vainilla | 8.07 | 1.22 | 2.96 | 1.97 |
| Figiulote | 4.55 | 3.02 | 2.44 | 1.40 |
| Caoboc | 5.17 | 11.59 | 2.48 | 4.32 |
| Laurel Macho | ...... | ...... | 1.60 | 0.74 |
| Madera Quebracho | 3.54 | 11.83 | 1.80 | 6.36 |
| Chaperno-Negro | 6.73 | 3.09 | 1.67 | 0.87 |
| Muchuguista | ...... | ...... | 1.49 | 0.70 |
| Guallabillo | 6.29 | 13.53 | 1.52 | 1.67 |
| Saray | 4.08 | 10.88 | 1.81 | 0.98 |
| Ojoche Macho | 4.45 | 1.80 | 1.81 | 0.78 |

| Variety. | Bark. Non-tannin. | Bark. Tannin. | Wood. Non-tannin. | Wood. Tannin. |
|---|---|---|---|---|
| Crucecito | 6.77 | 4.62 | 2.23 | 2.89 |
| Matazano | 3.17 | 1.83 | 2.78 | 1.80 |
| Yugualtel | 15.33 | 4.42 | 5.59 | 1.69 |
| Garilon | ...... | ...... | 1.91 | 1.32 |
| Chiguirin | 3.39 | 4.36 | 1.87 | 1.89 |
| Madrado | 4.34 | 3.12 | 4.13 | 7.36 |
| Guasimo Molinio | 9.08 | 9.31 | 3.61 | 1.68 |
| Zaray Blanco | 5.15 | 16.30 | 1.48 | 1.91 |
| Mangle | 7.20 | 7.36 | 4.88 | 1.75 |
| Laurel | ...... | ...... | 1.85 | 0.71 |
| Escobillo | 5.86 | 2.57 | 3.64 | 0.82 |
| Guapinol | 3.77 | 9.08 | 2.39 | 2.69 |
| Palote Arci | ...... | ...... | 3.15 | 2.59 |
| Lentisco | ...... | ...... | 1.18 | 0.21 |
| Zuata Piojo | 7.18 | 2.59 | 1.82 | 0.94 |
| Cortes | ...... | ...... | 1.80 | 1.21 |
| Calchocale | 4.73 | 2.64 | ...... | ...... |
| Zopilote | 22.13 | 2.92 | 6.33 | 1.35 |
| Cedro | 1.99 | 1.26 | 1.44 | 0.72 |
| Guayacan | 9.78 | 3.71 | 1.11 | 0.58 |
| Corteza | 8.21 | 2.85 | 3.14 | 1.55 |
| Papaturro | 3.17 | 11.18 | 0.59 | 1.40 |
| Mora | 5.49 | 2.82 | 3.62 | 2.10 |
| Guasimo Colorado | 7.59 | 2.26 | 1.38 | 1.18 |
| Sauce | 6.08 | 10.60 | 2.79 | 5.13 |
| Falalata | 6.07 | 1.76 | 5.88 | 1.23 |
| Virrey | 3.49 | 1.05 | 3.13 | 1.55 |
| Nambaro | 4.54 | 3.97 | 2.09 | 2.16 |
| Yugualti | 8.32 | 4.51 | 2.51 | 1.82 |
| Granadillo | 3.39 | 3.82 | 1.61 | 1.11 |
| Cortez | 11.02 | 4.05 | 1.86 | 0.54 |
| Guiliguiste | 4.60 | 4.04 | 3.50 | 2.50 |

F. P. VEITCH.

## PATENTS.

DECEMBER 6, 1904.

776,508. Thomas H. Fulghum, Grand Junction, Colo. Assignor one-half to Albert A. Miller, same place. **Purifying water.** Five pounds each of sodium bicarbonate and carbonate are mixed with one pound of sodium borate, and the mixture added to the water in suitable proportions, then an oxidizing solution of ferric chloride is added, the water agitated, aerated, settled and filtered.

776,543. Harry Pauling, Brandau, Austria-Hungary. **Ammonium formate.** A mixture of hydrogen, nitrogen, carbon monoxide and steam is treated with a non-luminous electric discharge in the presence of porous contact bodies, as spongy platinum.

776,563-4-5. Percy H. Thomas, Pittsburg, Pa. Assignor to Cooper-Hewitt Electric Co., New York, N. Y. **Current rectifier.** A vapor-containing vessel is raised above liquid containers with which it is connected by columns of mercury supported by atmospheric pressure, said columns forming circulating electrodes.

776,595. Henry C. Joehnk, Lyons, Iowa, and Hermann Wiese, Mt. Clemens, Mich. **Stock food.** Two parts each of bran, palm-seed meal, linseed oil cake, and malt refuse, with 12 parts of molasses and 4 of peat muck.

776,706. Heinrich Wachwitz, Herzbruch, near Nuremberg, Germany. Assignor to Wachwitz Syndicate, London, England. **Metal welding.** A copper sheet is plated on both sides with aluminum, then laid on the base metal, and the whole compressed at a temperature just below the oxidizing point of the base metal, then bringing the mass to a welding heat and rolling the whole together, the outer surface becoming a bronze.

776,830. Wm. Forger, New York, N. Y. **Cleaning white leather.** One pint each of oleic acid and ammonia is added to $49^3/_4$ gallons benzine, and the leather handled twice for fifteen minutes each time in the mixture, then for two minutes in a mixture of alcohol and ammonia 1, oleic acid 2, and benzine 8 parts, then twice for five minutes each time in the first bath, and finally in 20 gallons of benzine and 3 pounds of calcium chloride, finally rinsing the goods in benzine.

776,859. Wm. A. Low, Jr., Cranston, R. I. **Seamless gold-plated wire.** The inner surface of a gold tube is coated with a flux and has driven into it a solder tube diagonally divided lengthways so that it can be driven tight against the gold, the whole is then swaged together, cut into sections, and a core of base metal put in each section, the whole being then drawn to required size.

776,884. Augustus Bischler, Basle, Switzerland. Assignor to Basle Chemical Works, same place. **Indoxyl.** Alkali salts of the aryl-glycins are heated with alkalies and an alkali metal, and when the reaction is complete anilin is introduced, and the heat continued till the formation of the leuco body is finished.

776,885. Melchior Boniger, Basle, Switzerland. Assignor to Chemical Works formerly Sandoz, same place. **Green sulphur dye.** Alkali polysulphides react in the presence of copper or copper salts on aryl-1-paraoxyaryl-4-naphthalenediaminesulphonic acids to form green dyes soluble in water green, in sul-

phuric acid steel blue, diluted acids making blue flakes and alkalies in excess a blue precipitate.

776,952. Richard V. Skowroneck, Zwickau, Germany. **Metal pipe linings.** The inner surface of the pipe to be lined is electroplated, the lining in the shape of a pipe inserted, and the whole placed vertically in a mold with a core, and fused together.

776,999. Charles H. Caspar, Newark, N. J. **Mashing grain.** Malt is mixed with raw grain, the whole mashed in water and boiled in a vacuum, the vapors being condensed and returned to the mash, and liquid being forced upward into the mash to effect filtration.

DECEMBER 13, 1904.

777,072. Joseph M. Brown, and Lewis C. Smith, West Plains, Mo. **Tanning process.** The hides are washed in clear water, then fleshed and washed in a solution of borax 1–64, and coated with a mixture of extracts of oak or gum gambier 32, oil of cedar 1, and pulverized alum 8 parts.

777,112. Emil Kratockvil, Kraluv Dvur, Austria-Hungary. **Cleaning blast-furnace gases.** A casing is provided with a rotatable shaft carrying disks with pins on their faces, water jets directed towards the pins and gas inlets and outlets.

777,125. Armand Muller-Jacobs, New York, N. Y. Assignor to Catherine Muller Jacobs and Edward Weingartner, same place. **Explosive.** A sheet of nitrocellulose is printed on with a mixture of ammonium picrate 10, potassium chlorate 5, gum tragacanth, 20 and water 80 parts.

777,145. Carl Rubitschung, Frankfort-on-Main, Germany. **Artificial stone.** Broken stone is heated to 180° C., and tar to 150° C., then both are fed in suitable proportions into molds and compressed.

777,159. Virginia Tunbridge, Administratrix John Tunbridge, dec. **Apparatus for recovering precious metals.** A liquid supply enters through a screen the first of three conical vessels divided by partitions progressively higher, over the last of which the partially settled liquid runs into a filter-bed on a square tank from the bottom of which an upward passage leads to the top of a similar tank, duplicated as may be required.

777,173. Edward L. Allison, Saginaw, Mich. **Pavement compound.** Shale 18, sand 15, stone dust 6, pitch 10, and tar 5 parts.

777,273. Arthur E. Cattermole, London, England. **Separating metals.** Pulp is agitated with an amount of oil less than the metalliferous constituents, then granulated and classified, the sand gradually sifting out.

777,274. Arthur E. Cattermole, Henry L. Sulman and Hugh F. Kirkpatrick-Picard, London, England. **Concentrating**

**minerals.** An emulsion of soap and a mineral acid are added in place of oil in the preceding process.

777,278. John B. Davidson, Derby, Conn. Assignor one-half to Charles Mueller, New Britain, Conn. **Etching metals.** The surface is first coated with a varnish, then a design laid on in dry alkali and the plate steamed to remove the varnish below the alkali, and the plate is then etched in the usual manner.

777,323. Julius Abel, Mannheim, and Arthur Luttringhaus, Ludwigshafen-on-Rhine, Germany. Assignors to Badische Anilin und Soda Fabrik, same place. **Blue dye.** Methylene violet is caused to react with sulphur, sulphur chloride and sodium sulphide, producing a dye difficultly soluble in chloroform and hydrochloric acid blue to blue violet.

777,387. Jacob C. McClenahan, Wilmington, Del. **Molds for artificial stone.** Sand and petroleum jelly form a lining for the mold which prevents the escape of moisture.

777,406. Maurice E. Douane, Paris, France. Apparatus for making **methyl chloride.** Two vessels are arranged to form a closed annular chamber for hydrochloric acid and methyl alcohol, said chamber having an external jacket, liquid and steam supply and delivery pipes, and collecting and washing vessels between it and the condenser.

777,421. Edward Keller, Albert Ferrell and Kenneth W. McComas, Baltimore, Md. **Assay button dropper.** A handled frame carries a perforated plate and a sliding base plate to support the buttons in the perforations while placed in position, when the base plate is withdrawn by a slide on the handle to discharge the buttons.

777,485. Harry Pauling, Brandau, Austria-Hungary. **Heating air and forming nitrogen dioxide.** The air is passed back and forth through a set of heat regenerators at a temperature of 2,200° C.

777,486. As above, for **nitric acid.** Air at 1000° C., is subjected to a spark discharge whereby the nitrogen and oxygen form nitrogen dioxide, and this is converted into nitric acid.

777,503. Robert Friedlander, Chicago, Ill. **X-ray tube.** The tube has the usual terminals and also a compound terminal, enclosing gas-absorbing and gas-evolving material.

777,546-7. Leigh Roy Schaap, Loveland, Colo. Assignor to National Brazing Compound Co. **Brazing and brazing compound.** The parts to be united are properly heated, the following compound applied, and then the brazing metal. The compound is 4 parts each of potassium prussiate, plaster of Paris and borax, 2 parts citric acid and 1 of wood charcoal.

DECEMBER 20, 1904.

777,669. Albert Frank, Charlottenburg, Germany. **Hydro-**

**sulphites.** The cathode compartment of an electrolytic cell is filled with a neutral solution of a metallic bisulphite; the anode compartment contains a solution of an alkali metal compound, and hydrosulphites are produced in the cathode compartment if the bisulphite solution is kept neutral.

777,712. Thomas B. Aldrich and Charles P. Beckwith, Detroit, Mich. **Halogen tertiary butyl alcohol.** A ketone, as acetone, in excess and a halogen substitution product, like chloroform, are mixed at 0° C., and passed through a mass of broken fused potassium hydrate kept below 10° C., the product neutralized by calcium chloride, separated and distilled, the reaction being checked, if too violent by additional acetone and reduction of temperature.

777,734. Joseph Kempner, Berlin, Germany. **Opal glass.** Feldspar and sodium silicofluoride 100, silicic acid 170, and soda 45 parts, about.

777,794. Henry J. Livingston, Baltimore, Md. **Artificial stone.** The extract of coal tar made with hot water is combined with hydraulic cement to anneal the same.

777,829. Vincent G. Apple, Dayton, Ohio. **Gas.** Carbonaceous material is resolved into gas and incandescent coke by dry distillation in a heated area, the incandescent coke is extinguished by water that becomes steam, which is mixed with the first gas and the whole passed through the fuel.

777,905. Maximilian Kuner, Denver, Colo. **Vinegar apparatus.** An automatic tilting trough is provided with constant supply and delivery pipes, the latter feeding into the usual generators.

777,962. Arthur Liebrecht, Frankfort-on-Main, Germany. Assignor to Meister, Lucius und Brüning, Höchst-on-Main, Germany. **Iodoxy compound.** Iodoanisol is oxidized to iodoxyanisol, forming silvery white leaflets insoluble in alcohol and ether, difficultly soluble in cold, more readily in hot water, easily recrystallized from formic and acetic acid, and melting with simultaneous combustion at about 225° C.

777,987. Ernest E. Werner, St. Louis, Mo. **Apparatus for treating gases.** An inclosed chamber with inlet and outlet, electric arc terminals and current supply, and a regulated blast of air, whereby the arc is deflected and elongated transversely without breaking it.

777,988–9–90–91. All as above for modifications of the **apparatus.** All are assigned to Electrical Purifying Co., Stafford, Kansas.

777,995. John Anderson, Monaca, Pa. **Fire-brick.** Silica 90, asbestos and fire clay 5 parts each and sufficient salt water.

778,025. Ricardo Fortun and Eduardo Semprun, Madrid,

Spain. **Aluminum solder.** Tin 3200, zinc 800, aluminum and zinc sulphide 100 each. Fifteen parts of this mixture are added to 85 parts of phosphorus and silver 2 each, aluminum 6 and tin 10 parts, the phosphorus being added just before setting after fusion.

778,036. Eduard Hepp, Frankfort-on-Main, and Rudolf Uhlenhuth, Höchst-on-Main. Assignors to Meister, Lucius und Brüning, Höchst-on-Main, Germany. **Anthraquinone dye.** 1-4-diparatoluido-5-oxyanthraquinone is sulphonated, giving as sodium salt a green powder soluble in water, unchanged by sodium carbonate, but turning bluer on adding caustic alkalies, soluble in concentrated sulphuric acid green, and dyeing unmordanted wool, and chromed wool and cotton green shades.

778,096. John W. Barnes, Philadelphia, Pa. Assignor one-half to Clara G. Hobson. **Coal briquets.** Granulated coal 2000, and molasses 36 parts are briquetted with sufficient water, then heated to 300° F., sprinkled with a mixture of paraffin and hot water, and finally dried.

778,099. Henry S. Blackmore, Mt. Vernon, N. Y. **Sulphur trioxide.** Sulphur dioxide and air or oxygen are passed into a tube provided with a series of wire gauze disks strung on a central rod and provided with electric connections, the quantity and temperature of the combining gases being regulated to avoid dissociation of the trioxide formed.

778,100. Henry S. Blackmore, Mt. Vernon, N. Y. **Reducing aluminum.** Aluminum oxide is acted on by magnesium and acetylene at a suitable temperature.

778,149. Wm. B. Simmons, Charleston, S. C. **Pyrites furnace.** Several superimposed series of semicircular grate bars with stirrers, all arranged to pass the pyrites from one series of bars to the next below.

778,166. Wilhelm Biber, Berlin, Germany. Assignor one-half to Isidor Wiesbader, New York, N. Y. **Bread.** Flour 280, and prepared sago 21 parts. The bread remains fresh longer than when made with flour alone. The sago is soaked in boiling water, 1 to 2, till a jelly is formed, before adding it to the flour.

778,173. Charles F. Cross, London, England, and John Traquair, Paisley, Scotland. Assignors to Wm. Wortherspoon, Paisley, Scotland. **Soluble starch.** The starch is dried at 80 to 100° C. then moistened with 10 per cent. anhydrous acetic acid, heated, washed and dried. It is completely soluble, does not gelatinize, resists the action of ferments, and dries to an elastic continuous film.

778,175. Leopold H. Dehoff, Mannheim, and Gustav Wessbecher, Ludwigshafen-on-Rhine. Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. **Compound**

**dye.** Palatine chrome black 5, alkali violet 4BN,3, 4BN and Glauber salt 40 parts.

778,182. Herbert S. Elworthy, London, England. Assignor one-half to Ernest Henry Williamson, same place. **Hydrogen generator.** A rectangular furnace is provided with a series of horizontal trays filled with pulverized iron in shallow layers, leaving between them zigzag shallow flues for the passage of steam or reducing gas.

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778,232. Carleton Ellis, Boston, Mass. **Cement for cloth, etc.** Creosote 1, amyl acetate 4, acetone 30, nitrocellulose 10, and camphor 4 parts by weight.

778,243. Fritz Hoffman, Elberfeld, Germany. Assignor to Farbenfabriken von Elberfeld Co., New York, N. Y. **Dialkyl carbinols.** Cyclocitraliden acetic acid is treated with magnesium methyl bromide and the resulting compound is decomposed by stirring with ice water and distillation by steam of the ethereal solution, the product being a limpid oil, having a violet odor and boiling at 130° C., 20 mm. pressure.

778,270. Isaiah L. Roberts, New York, N. Y. Assignor one-half to James Turner, Morehead, New York. **Magnesium.** A fused bath of magnesium fluoride and an alkaline chloride with a salt of lithia.

778,277. Carl F. Schaerges, Basel, Switzerland. Assignor to F. Hoffmann-Laroche, same place. **Chloral acetone chloroform.** Chloral hydrate 16.55 and acetone chloroform 17.75 are heated together in molecular proportions, dissolved in benzene at high temperature and crystallized out, forming crystals melting at 65°, having a faint odor and taste of camphor, sparingly soluble in cold water, very soluble in dilute alcohol, subliming on cautious heating. Formula, $C_6H_8O_2Cl_6$.

778,286. Elihu Thomson, Swampscott, Mass. Assignor to General Electric Co., N. Y. Making **quartz articles.** A form of refractory conducting material is surrounded by quartz in a divided state and the whole heated by an electric current till the quartz is fused, and when cool the form is broken out.

778,321. Antoinette Macaulay, Fort Dodge, Iowa. **Wood preserving compound.** Linseed oil 4, kerosene 2, and sodium silicate 1 pound. Powdered charcoal may be added.

778,345. Frederick C. Weber, Chicago, Ill. **Reducing metallic oxides** with aluminum. A mixture of the metallic oxide and aluminum is first dried and the oxides and sulphides decomposed at one operation, the charge then sealed in briquets before final reduction.

778,391. James H. White, Hendersons Cross Roads, Tenn. **Water insecticide.** Water 1½ gals., carbolic acid 1 lb., aqua ammonia

1 lb., Fowler's solution of arsenic $1^1/_2$ lbs., copper arsenite $3^1/_2$ oz., and corrosive sublimate 2 oz. Twenty per cent. petroleum may be added.

778,398. Christopher H. Bierbaum. **Alloy.** Zinc 86, copper $9^9/_{10}$, aluminum 4, and magnesium $^1/_{10}$ per cent.

778,445. Herbert H. Church, Bellows Falls, Vt. Assignor to Casein Co. of America, in N. J. **Wax emulsion.** Paraffin, stearic acid and Chinese tallow each 50 parts, trisodium phosphate and caustic soda 5 each, water as required.

778,477-8. Karl Elbel, Biebrich, Germany. Assignor to Kalle and Co., same place. The first for **$\beta$-naphthol azo dye.** From $\beta$-naphthol and 1-2-amidonaphthol sulphonic acids in highly concentrated solution and excess of alkali, a dark brown powder dissolving in water blue red, in concentrated sulphuric acid blue, dyeing wool from acid bath bright red, turning blue black on chroming.

The second is for **monochlor-$\alpha$-naphthol.** White prismatic crystals melting at 64 to 65° C., with pungent smell and easily soluble in benzene, alcohol and ether.

778,479. As above for **blue sulphur dye.** The product of the previous patent is oxidized with a paradiamine of the benzene series and the resulting indophenol heated with alkali polysulphides.

778,529. Frederick H. Bruening, Pittsburg, Pa. **Insulating material.** Cork is dried and 26 parts added to pitch 38, ground flint 16, clay and feldspar 8 each, and 2 parts each of rosin and litharge, the whole heated and mixed.

778,547. Lewis E. Porter, Camp Rochester, Cal. **Precipitating metals** from cyanide solutions. The ore solution is treated with zinc shavings to throw down gold and silver, then with ammonia and zinc dust to precipitate copper and regenerate the cyanide solution.

778,556. Samuel L. Summers, Philadelphia, Pa. **Acetylsalicylphenetidine.** Acetylsalicylic acid is made to react on paraphenetidine in the presence of xylene as a solvent, the mixture is heated till it is dissolved, cooling, separating the crystals and purifying them.

778,594. Pancrazio M. Megaro, Newark, N. J. **Shaving composition.** White poplar ashes and tallow 16 parts each, unslaked lime $2^1/_2$, essence of bitter almonds $^1/_{80}$ part, and sufficient water in which it is boiled and cooled.

778,610. Karl Schirmacher, Höchst-on-Main. Assignor to Meister, Lucius und Brüning, same place. **Black disazo dye.** Metaphenylenediaminesulphonic acid is tetrazotized with an excess of nitrite, and then combined with $\beta$-naphthol.

778,656. Otto J. Graul. Assignor to Badische Anilin und Soda Fabrik, all of Ludwigshafen-on-Rhine, Germany. **Acid**

**nitriles.** A Schiff base is heated with hydrocyanic acid in dilute alcohol. The base may be anhydroformaldehyde aniline.

778,667. Elijah M. Houghton, Detroit, Mich. **Blackleg vaccine.** The dried muscles from an animal affected with blackleg are dried and powdered, heated to attenuate the virus, the finer particles separated and mixed with normal cow serum, again attenuated by heat, caused to be of uniform strength and dried.

778,670. Michael Jljinsky, Krefeld, Germany. **Orthodioxyanthraquinone sulphonic acid.** Orthoanthraquinone sulphonic acids are converted into the corresponding oxy derivatives by heating the alkali salts of said sulphonic acids under pressure with compounds of the alkaline earths and oxidizing reagents. The orthodioxyanthraquinonemonosulphonic acid dyes mordanted wool violet red, and forms a barium salt in orange-colored needles difficultly soluble in cold water.

778,703. Rudolf Peters, Heidelberg, Germany. Utilizing the **waste ends of carbons.** The ends are heated to 2000° C. and while heated put in a bath of oil, cooled and allowed to dry, then pulverized for making ink, paints, etc.

778,713. Albrecht Schmidt, Höchst-on-Main. Assignor to Meister, Lucius und Brüning, same place. **Violet sulphur dye.** Safraninon is heated with sulphur, forming an insoluble violet black powder, soluble in concentrated sulphuric acids violet black, in alkaline sulphides violet red.

778,725. Daniel Vorlander and Brono Drescher, Halle-on-Saale, and Paul Seidel, Ludwigshafen-on-Rhine. Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. **Acylated indoxyl.** Acetic anhydride is made to react on indoxyl, forming crystals that melt at 125° C., soluble in alcohol and ether but insoluble in cold dilute caustic soda excluding oxygen, gives no color reaction with ferric chloride, and makes indigo on heating with caustic soda and air.

778,747. James H. Gillies, Melbourne, Victoria, Australia. Apparatus for **separating sulphides** from their ores. A large funnel-shaped vessel has stepped sides, a supply of cold water to the bottom of the vessel, which carries away the separated sulphides without lowering the temperature of the upper heated part of the vessel.

778,752. Rudolph Knietsch, Paul Seidel and Otto J. Graul. Assignors to Badische Anilin und Soda Fabrik, all of Ludwigshafen-on-Rhine, Germany. Process of making **indigo.** A phenylglycocoll derivative is treated with more barium oxide than required to take up all its water, and with caustic potash containing less than 10 per cent. of water, the mixture being kept nearly anhydrous.

778,772. Wilhelm Behagel and Gustav C. Schumann. Assignors to Badische Anilin und Soda Fabrik, all of Luwigshafen-on-Rhine, Germany. **Hydroxyalkylaniline.** Glycolchlorhydrin is heated with aniline in the presence of water and of sodium acetate.

778,781. George H. Herbein, San Francisco, Cal. **Artificial fuel.** An alkali is added to peat and the same charred, then mixed with a solution of resin in petroleum and a drier and dried.

778,783. Julius Hofmeier, Vienna, Austria-Hungary. Assignor to Actien-Gesellschaft für Chemische Industrie, same place. **Blood food.** Blood is coagulated with alkali at 60° to 90° C., hydrochloric acid added and the precipitated albuminates separated by pressing and drying at a low temperature.

WILLIAM H. SEAMAN.

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## INORGANIC CHEMISTRY.

**Inorganic Chemistry and the Phase Rule.** BY WILDER D. BANCROFT. *J. Elisha Mitchell Sci. Soc.*, 20, 39–46.—The author compares the periodic law with the phase rule and states that the former correlates the facts in regard to the properties of the elements and their compounds, while the latter is concerned only with the methods of preparation and separation. The phase rule offers a rational basis for the classification of phenomena and is a most valuable instrument of research. Various examples illustrating the different systems are cited. The fact that the phase rule has been applied only to inorganic chemistry is pointed out, but the author hopes to see it also applied to organic chemistry.

HENRY FAY.

**The Production of Magnetic Alloys from Non-magnetic Metals.** BY R. A. HADFIELD. *Chem. Eng.*, 1, 256–257.—The author remarks upon the magnetic alloy produced by Dr. Heusler. The alloy contained 60 per cent. copper, 25 to 27 per cent. manganese and 12 per cent. aluminium. The magnetic properties are evidently produced by manganese, inasmuch as aluminium-copper alloys are not magnetic, but the magnetisability increases with increase of aluminium, the maximum for any stated percentage of manganese being attained when the alloy contains one atom of manganese to one of aluminium. The alloy is brittle and cannot be forged.

HENRY FAY.

## MINERALOGICAL AND GEOLOGICAL CHEMISTRY.

**The Abstraction of Oxygen from the Atmosphere by Iron.** —BY C. H. SMYTH, JR. *J. Geol.* 13, 319–323.—The author endeavors to ascertain from the best available data if the abstraction of oxygen by ferrous compounds in the weathering of the

primitive rocks is a factor not to be disregarded in any attempt to work out the geological history of the atmosphere. Although his figures differ from those of Van Hise (A Treatise on Metamorphism, pp. 950, 951), they lead to a similar general conclusion, that the factor is a very important one. Admitting a lack of even approximate accuracy, the oxygen abstracted by iron is calculated to be 68.8 per cent. of that now in the atmosphere.

W. F. HILLEBRAND.

**The Petrographic Province of Central Montana.** BY L. V. PIRSSON. *Am. J. Sci.*, 20, 35–49; map.—In this paper the author describes the consanguinity and general family relations of the rocks of several foci of igneous activity occupying an area about 150 miles long and 100 wide, and comprising the Castle, Little Belt, Judith, Highwood, Bearpaw and Little Rocky Mountains. It is a general summation along this line of the author's previous work on these mountain groups. "The evidences of consanguinity are to be seen in two ways, in certain mineral peculiarities and in the chemical composition of the magmas, the first being dependent upon the second in conjunction with the physical conditions attendant upon crystallization." Chemically the province is characterized by the fact that in the most siliceous magmas, which in general are found around the edges of the province, the percentages of potash and soda are about equal; with decreasing silica and increasing lime, iron and magnesia, the potash relatively increases over soda, until in the least siliceous magmas, towards the center of the province, it strongly dominates. The bearing of these observations on rock differentiation is conservatively discussed. Finally the author draws the attention of petrographers to a phase of occurrence of rock types in this province, which he terms *regional progression of types*, and invites to the study of other provinces with a view to ascertain if it is of general occurrence or not.

W. F. HILLEBRAND.

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## ANALYTICAL CHEMISTRY.

**An Electrical Method for the Combustion of Organic Compounds.** BY H. N. MORSE AND L. S. TAYLOR. *Am. Chem. J.*, 33, 591.—A thin glass combustion tube 15 mm. inside diameter, 350 mm. long, is closed at one end by a rubber stopper through which passes a porcelain tube 6 mm. in diameter, 250 mm. long, a glass tube serving as the outlet for the products of the combustion, and a stout platinum wire (No. 18 B. and S. gauge). Outside the stopper the porcelain tube is joined to a branched glass tube, through one branch of which is passed air or oxygen and through the other a platinum wire also No. 18. At a distance of about 70 mm. from the stopper, this wire is joined to a smaller platinum wire (No. 29) which passes through the porcelain tube

to its inner end and then returns on the outside in a series of suspended coils, being joined to the No. 18 wire passing through the stopper. The larger wires are used to avoid burning the rubber stopper. The smaller wire is about 1.75 meters long and should not touch the combustion tube at any point. Beyond the platinum coils is placed a roll of copper gauze 60 mm. long and then the boat containing the substance to be burned. The other end of the combustion tube may be closed, or as is more convenient, a second roll of copper gauze may be inserted next to the boat and the tube closed with a rubber stopper carrying a small glass tube, through which is passed a slow stream of air or oxygen. In this case, the combustion tube should be a little longer than when a closed tube is used. The absorption apparatus being in place, a slow stream of air or oxygen is admitted through the porcelain tube and the wire coils gradually raised to a bright red heat. The gauze is then heated with a burner giving a thin broad flame, to a temperature at which the copper is easily oxidized. The substance in the boat is then heated and the combustion finished in the usual manner. The entering air is heated by the hot wire within the porcelain tube and the coils outside complete the burning of any unoxidized material coming from the rear. When an open tube is used, air or oxygen should be admitted at the rear at sufficient rate to prevent the accumulation of volatilized matter behind the boat. In any case the copper gauze should be loosely rolled to allow rapid diffusion of the gases. When the substance to be burned contains halogens, a roll of silver foil is inserted next to the porcelain tube and not heated directly. If nitrogen is present, a reduced copper roll is introduced next to the porcelain tube and most of the oxygen supplied from the rear. Sulphur compounds may also be burned, using next to the porcelain tube, a cartridge of lead chromate in a shell made of fine copper wire. The process described has been in use for over a year with very satisfactory results. Its advantages are saving in energy, space and time. The electrical energy is small, being about 3.6 amperes at 54 volts (194.4 watts, or one-third of a horse-power) when the highest temperature is being maintained. The time required is about half an hour for substances containing only carbon, hydrogen and oxygen, but with practice this may be considerably reduced.

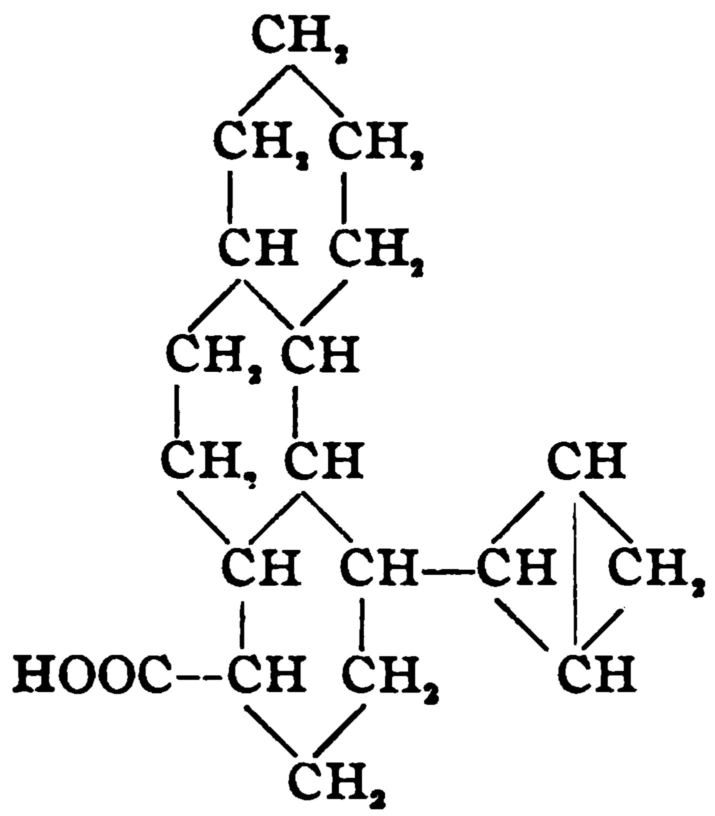
T. G. DELBRIDGE.

**The Determination of Acetic Acid in White Lead.** BY G. W. THOMPSON. *J. Soc. Chem. Ind.*, **24**, 487.—Eighteen grams of the dry white lead are placed in a 500 cc. flask, this flask being arranged for connection with a steam supply and also with an ordinary Liebig condenser. To this white lead are added 40 cc. of syrupy phosphoric acid, 18 grams of zinc dust, and about 50 cc. of water. The flask containing the material is heated directly and distilled down to a small bulk. Then steam is passed into the

flask until it becomes about half full of condensed water, when the steam is shut off and the original flask heated directly and distilled down to the same small bulk—the operation being conducted twice. The distillate is then transferred to a special flask and 1 cc. of syrupy phosphoric acid added to ensure a slightly acid condition. The flask is then heated and distilled down to a small bulk, say 20 cc. Steam is then passed through the flask until it contains about 200 cc. of condensed water, when the steam is shut off and the flask heated directly. These operations of direct distillation and steam distillation are conducted until 10 cc. of the distillate require but a drop of tenth-normal alkali to produce a change in the presence of phenolphthalein. Then the bulk of the distillate is titrated with tenth-normal sodium hydroxide, and the acetic acid calculated. Since the distillate is often rather large, it is convenient to titrate it in 200 cc. portions as fast as it comes over. If the lead contains much chlorine, it is well to add a little silver phosphate to the second distillation flask and not to carry the distillation too far. T. G. DELBRIDGE.

## ORGANIC CHEMISTRY.

**Contribution to the Question of the Constitution of Abietic Acid.** BY H. ENDEMANN. *Am. Chem. J.*, 33, 523–534.—*Abietic Acid Contains One Carboxyl Group.*—Abietic acid heated at 160°, in a sealed tube, with excess of acetic anhydride, gives a compound in which one molecule of abietic acid is combined with but one molecule of acetic acid. Hence, abietic acid contains one carboxyl group, and not (as stated by Tschirch and Studer) two hydroxyls. *Oxidation of Abietic Acid by Permanganic Acid in Acid Solution.*—The oxidation was conducted at low temperature. An aldehyde acid, $C_{16}H_{24}O_3$, a dicarboxylic acid, $C_{16}H_{24}O_4$, and malonic acid, were noted as products of the oxidation. The *dibasic acid*, $C_{16}H_{24}O_4$, may be obtained in small crystals by the slow evaporation of its aqueous solution. Dried in the air, it melts at 80° with loss of one molecule of water, after which it melts at 111–113°. It forms an oily *diacetyl derivative*. *Barium* and *lead salts* were prepared and studied. A chloroform solution of the acid treated with excess of bromine, gave four molecules of hydrobromic acid for every two atoms of bromine added, indicating the change of a —$CH_2.CH_2$— grouping to a —CBr:CBr—. The *aldehyde acid*, $C_{16}H_{24}O_3$, melts at 188°, but even at 100° tends to lose water and pass into an anhydride. It gives characteristic aldehyde reactions. *Lead* and *barium salts* were prepared. In view of the above oxidation products, the following structural formula is suggested for abietic acid:



The acids obtained by the permanganic oxidation (which would break down the $C_4H_5$ ring) would then be *tetradecahydrophenanthrenal carboxylic acid*, $C_{16}H_{24}O_3$, and *tetradecahydrophenanthrene dicarboxylic acid*, $C_{16}H_{24}O_4$. M. T. BOGERT.

**The Hydrazine Derivatives of Tetrachlorphthalic Acid.** BY ISAAC KING PHELPS. *Am. Chem. J.*, 33, 586–590.—Tetrachlorphthalic acid gives primary hydrazides of the type, $R(CO.NH.NH_2)_2$, and secondary hydrazides of the type $R\left\langle\begin{array}{l}CO—NH\\ \quad\quad\;\; |\\ CO—NH\end{array}\right.$, both of which are characterized by high melting-point, stability, inertness, and acidic properties. EXPERIMENTAL.—*Primary hydrazide combined with hydrazine*, $C_6Cl_4(CONH.NH_2)_2.N_2H_4$, from diethyl tetrachlorphthalate and hydrazine hydrate, crystallizes from alcohol in fine yellow feathery needles, charring without melting at 290–300°. By boiling with excess of alcoholic hydrochloric acid, the *free hydrazide* was obtained as a colorless insoluble solid, which does not take up halogen acids. *Secondary Hydrazide*, $C_6Cl_4(CO.NH)_2$.—This was prepared by heating together tetrachlorphthalic acid and hydrazine hydrate, and crystallizing the product from glacial acetic acid. It forms pale-yellow crystals, melting with slight decomposition at 286–287°, insoluble in ordinary organic solvents, soluble in sodium or potassium hydroxides, but not in sodium carbonate or ammonium hydroxide. *Sodium, potassium*, and *silver salts* were prepared of the general type, $C_6Cl_4(CO.N)_2HM$. *Diacetyl derivative*, $C_6Cl_4(CO.NCOCH_3)_2$, m. p. 203–204°. *Ethyl carboxylate*, $C_6Cl_4(CO.N)_2HCOOC_2H_5$, from the silver salt of the hydrazide and ethyl chlorcarbonate, crystallizes from alcohol in white prisms, m. p. 244–245°. In the above experiments, the hydrazine hydrate showed no inclination to react with the chlorines of the benzene nucleus.

M. T. BOGERT.

**A Convenient and Practical Method for Making the Ester of Mesoxalic Acid.** BY RICHARD SYDNEY CURTISS. *Am. Chem. J.*, 33, 603–604.—By saturating diethyl malonate, at —15°, with the gaseous oxides of nitrogen obtained from nitric acid and arsenic trioxide. crystals are obtained which, by a single recrystallization, give pure diethyl mesoxalate in fair yield.

M. T. BOGERT.

**On the Pinacone-Pinacolin Rearrangement.** BY P. J. MONTAGNE. *Am. Chem. J.*, 33, 604–605.—Acree's attention is called to the publications of the author upon the pinacone-pinacolin rearrangement and their bearing upon the former's contemplated investigations.

M. T. BOGERT.

**On Two Aromatic Nitroso Compounds.** BY FREDERICK J. ALWAY AND ROSS A. GORTNER. *Ber.*, 38, 1899–1901.—*m-Dinitrosobenzene*, $C_6H_4(NO)_2$, was obtained by reducing *m*-dinitrobenzene, in alcoholic solution, with zinc and glacial acetic acid, at temperatures below 0°, adding ferric chloride solution, and distilling with steam. From the first portions of the distillate, which are emerald-green in color, a yellow powder rapidly separates, melting at 146.5° to a green liquid which quickly decomposes. This dinitrosobenzene may be obtained in microscopic crystals from solution in glacial acetic acid, or from a mixture of alcohol and ether. It gives green solutions, which gradually turn a brownish red. The same substance may be produced from *m*-nitronitrosobenzene by similar treatment. *m-Nitronitrosobenzene*, $O_2N.C_6H_4.NO$.—In the above steam distillation, twenty-six fractions of 10 cc. each were collected. From the first two fractions, the dinitrosobenzene separated as mentioned. From fractions 3 and 4, mixtures of nitronitroso- and dinitrosobenzene separated; from 5, nearly pure nitronitroso; from 6-10, diminishing amounts of nitronitrosobenzene and increasing amounts of bluish green needles; from 10-16, only bluish green needles; from 17-26, only the needles, the depth of color steadily decreasing, the last crystals being nearly colorless. The needles from fractions 6-26 were found to be only solid solutions of nitronitrosobenzene in dinitrobenzene, the last fractions containing but little of the nitroso compound. By reducing dinitrobenzene at 50–80°, only traces of the dinitroso compound were found, together with the nitronitrosobenzene. In contact with boiling water, the latter gradually decomposes with formation of *m,m*-dinitroazoxybenzene.

M. T. BOGERT.

**On the History of the Theory of the Formation and Constitution of Sodium Acetacetic Ester.** BY ARTHUR MICHAEL. *Ber.*, 38, 1922–1937.—The Claisen explanation of the course of the acetacetic ester synthesis is criticized as being not in accord either with the theoretical considerations involved, or with

the observed experimental facts. The author believes that the condensation occurs as follows, and gives his reasons for this belief:

$2CH_3COOC_2H_5 + Na_2 = 2CH_2 : C(ONa)(OC_2H_5) + H_2.$

$CH_2 : C(ONa)(OC_2H_5) + CH_3COOC_2H_5 =$
$CH_3.C(ONa)(OC_2H_5)CH_2.COOC_2H_5.$

$CH_3.C(ONa)(OC_2H_5)CH_2.COOC_2H_5 =$
$CH_3.C(ONa) : CH.COOC_2H_5 + C_2H_5OH.$

M. T. BOGERT.

**Some Alkaloids of the Death Camas.** BY HENRY B. SLADE. *Am. J. Pharm.*, 77, 262–264.—A preliminary study of the death camas indicates the presence in it of at least three distinct alkaloids, sabadine, sabadinine, and veratralbine, the latter probably derived from protoveratrine. M. T. BOGERT.

**A Contribution to Our Knowledge of Syntheses with Sodium Acetacetic Ester.** BY ARTHUR MICHAEL. *Ber.*, 38, 2083–2096. —Claisen and Haase explain the formation of sodium diacetacetic ester from sodium acetacetic ester and acetyl chloride by assuming that acetyl chloride first reacts with the sodium acetacetic ester to form the *O*-acetyl derivative, which is then changed to the sodium diacetacetic ester by the sodium acetacetic ester present. The author is of the opinion that this explanation is incorrect, and gives his reasons for this opinion. He believes that the production of the sodium diacetacetic ester is due either to the previous formation of diacetacetic ester, $CH_3.C(ONa) : CH.COOR + CH_3COCl = CH_3.C(ONa)Cl.CH(COCH_3).COOR = (CH_3.CO)_2CH.COOR + NaCl$, which then reacts with sodium acetacetic ester; or, more probably, to the combination of two molecules of sodium acetacetic ester with one of acetyl chloride to a large molecule, which then breaks down with formation of sodium diacetacetic ester, etc. The action of an acyl chloride upon a metallic derivative of acetacetic ester depends both upon the character of the acyl chloride and upon the metal, and this is the explanation of a number of hitherto puzzling facts in the field of acetacetic ester syntheses. Copper, being a less positive metal than sodium, requires a weaker acid in order that as much as possible of its total energy may be changed into heat and combined energy. Thus the various reactions may be explained on the basis of the Neutralization Law, which shows clearly why in some cases *O*-derivatives, in others *C*-derivatives, result. The product obtained by the action of acetyl chloride upon sodium ethylacetacetic ester is the *O*-acetyl ethylacetacetic ester and not the *C*-diacetyl derivative. EXPERIMENTAL: *Comparison of O-Acetylacetacetic Ester of Various Origin.*—The *O*-acetyl derivative obtained from acetyl chloride and copper acetacetic ester is identical with that obtained from acetyl chloride and acetacetic ester in pyridine solution. At 12 mm. pressure, its boiling-point is 99–99.5° (corr.). *Behavior of*

*O-Acetylacetacetic Ester and Acetyl Chloride towards Sodium Acetacetic Ester.*—By the action of sodium acetacetic ester upon *O*-acetylacetacetic ester, no *C*-diacetacetic ester was formed; but the latter was the chief product when acetyl chloride acted upon sodium acetacetic ester suspended in ether.—*O-Carboxethylacetacetic Ester and Sodium and Copper Acetacetic Ester.*—*O*-Carboxethylacetacetic ester was heated with sodium and with copper acetacetic ester, but in neither case could any diacetacetic ester be found in the product. *Acetyl Chloride and Copper Ethylacetacetic Ester.*—Copper ethylacetacetic ester is a grass-green powder, difficultly soluble in ordinary solvents, and rapidly decomposed by warm water. The dry powder is decomposed at 100°, but on rapid heating melts with effervescence at 188-189°. Treated with acetyl chloride, in ether solution, the *O*-acetyl derivative was obtained. The same product resulted when the sodium derivative was used instead of the copper derivative. It is an oil, boiling-point 121° (corr.) at 17 mm., 123° (corr.) at 20 mm. *Mercuric Oxide and Acetacetic Ester.*—Mercuric oxide, warmed with excess of acetacetic ester, gives a body of the probable constitution,

$$\begin{array}{l} CH_3.CO.CH.COOR \\ \qquad\qquad\quad \rangle Hg \\ CH_3.CO.\ C.COOR \\ \qquad\qquad\quad \rangle Hg \\ CH_3.CO.CH.COOR \end{array}$$

It is a white, insoluble, crystalline substance, very stable towards water or dilute acids. *Preparation of Alkylacetacetic Esters in Ether.*—The free acetacetic ester formed in these reactions is best removed by treatment with dilute ammonia, which dissolves it without dissolving the alkylacetacetic ester. Sodium acetacetic ester was treated, in ether solution, with the alkyl iodide, or a mixture of acetacetic ester and the alkyl iodide was treated with sodium ethylate. Methyl or allyl iodides gave much better yields of the monoalkyl derivatives than ethyl iodide. The latter reacts more readily with the sodium derivative of ethylacetacetic ester than with the sodium derivative of acetacetic ester itself. *Preparation of Pure Alkylacetacetic Esters.*—All known methods for the preparation of alkylacetacetic esters give mixtures from which it is exceedingly difficult to get any pure product without considerable loss of material. The various methods were tested with crude ethylacetacetic ester and methylacetacetic ester, and the results are given. The purification of the dialkylacetacetic esters is best accomplished by shaking the rectified fractions with potassium hydroxide solution. M. T. Bogert.

**On Formylacetacetic Ester and α-Formylpropionic Ester.** By Arthur Michael. *Ber.*, 38, 2096–2105.—The purpose of

these experiments was to compare the behavior of $\alpha$-formyl acid esters and $\beta$-keto acid esters with various reagents. By the action of resorcinol upon the sodium derivatives of formylacetic and acetacetic esters, umbelliferon and methylumbelliferon have been obtained. It is now shown that $\alpha$-methylumbelliferon can be obtained in similar manner by the action of resorcinol upon sodium formylpropionic ester. The smooth formation of *C*-homologues, so characteristic of sodium acetacetic ester, does not occur so readily with sodium formylacetic ester or sodium formylpropionic ester. By the action of diazobenzene salts upon sodium acetacetic ester, the phenylazo group attaches itself to carbon. The sodium derivatives of formylacetic and acetacetic esters show a similar behavior; in the case of the formylacetic ester the final product is formazylcarbonic ester, while with formylpropionic ester it is phenylhydrazonepyroracemic ester. With hydroxylamine, formylacetic and formylpropionic esters both form oximes, like acetacetic ester. With phenylhydrazine, in presence of excess of hydrochloric acid, $\alpha$-formylpropionic ester forms a pyrazolone, just as acetacetic ester does; with free phenylhydrazine, however, formylpropionic ester gives also an isomeric pyrazolone. EXPERIMENTAL: *Sodium formylpropionic ester and resorcinol* react to form *$\alpha$-methylumbelliferon.*—The latter forms white prismatic needles, melting at 217-219° with previous softening. It is difficultly soluble in hot water, quite easily soluble in cold alcohol. In alkalies, it dissolves with blue fluorescence, and is reprecipitated by the addition of acids. *Sodium formylacetic ester and methyl iodide* gave a very small yield of formylpropionic ester, together with some trimesic ester, and a neutral oil (boiling-point 69° at 21 mm.). *Sodium formylpropionic ester and methyl iodide* gave a very small amount of a substance which was probably impure $\alpha$-formylisobutyric ester. *Sodium Formylacetic Ester and Diazobenzene Chloride.*—The first product of the reaction was *formylglyoxylic ester phenylhydrazone*, $C_6H_5NH.N:C(COOR)CO.H$, the final product being formazylcarbonic ester. The formylglyoxylic ester phenylhydrazone combines with phenylhydrazine to a *phenylhydrazone*, $C_{17}H_{18}O_2N_4$, which crystallizes from alcohol in bright yellow prisms, m. p. 215-217°. *Sodium formylpropionic ester and diazobenzene Chloride* gave phenylhydrazonepyroracemic acid ethyl ester. *formylacetic ester and hydroxylamine* gave an *oxime*, which crystallizes from a mixture of petroleum ether and benzene in long white prisms, m. p. 57-59°. The *oxime* obtained from *$\alpha$-formylpropionic ester and hydroxylamine* remained as an oil, and could not be purified. *$\alpha$-Formylpropionic Ester and Phenylhydrazine Hydrochloride.*—The product was *N-phenyl-2-methylpyrazolone*, small prisms, m. p. 147-148°. *$\alpha$-Formylpropionic ester and phenylhydrazine* gave the same N-phenyl-2-methylpyrazolone,

together with an isomer, crystallizing in poorly formed plates and prisms, m. p. 124-126°. M. T. BOGERT.

**Determination of Methoxyl Groups in Some Lignocelluloses.** BY ALVIN S. WHEELER. *Ber.*, 38, 2168-2169.—Benedikt and Bamberger determined the percentage of methoxyl present in various woods, and found it to average 2.62, calculated as methyl. The author has analyzed fifteen other woods, by the Zeisel method, and find the average methyl percentage to be 2.39. Most of the woods analyzed were collected in the neighborhood of Chapel Hill, N. C. The results are tabulated. M. T. BOGERT.

**On the Isoureas.** BY J. STIEGLITZ AND R. W. NOBLE. *Ber.*, 38, 2243-2244.—The preparation of the isourea is most conveniently carried out by treating a mixture of equal molecules of cyanamide and cyanamide dihydrochloride with a slight excess of the required alcohol. The reaction then proceeds as follows: $H_2N.CCl:NH + HOR = H_2N.C(OR):NH.HCl$. EXPERIMENTAL.—*O-Ethylisourea hydrochloride*, $H_2N.C(OC_2H_5):NH.HCl$ yields almost quantitative. *Chlorplatinate*, $C_6H_{18}N_4O_2PtCl_6$. *O-Propylisourea hydrochloride*, $H_2N.C(OC_3H_7):NH.HCl$; m. p. 64°, decomposes at 121°. *Chlorplatinate* was also prepared.

M. T. BOGERT.

## INDUSTRIAL CHEMISTRY.

**A New Diaphragm Cell for Electrolysis of Sodium Chloride Solutions.** BY C. P. TOWNSEND. *Electrochem. and Metal. Ind.*, *May*, 1905.—In this process an effort is made to isolate as completely as possible the chlorine formed at the cathode from the sodium hydroxide formed secondarily at the anode by preventing the mechanical mingling of the solutions. This is done by having the cathode portion of the electrolyte practically confined to the interstices of an asbestos diaphragm and as the caustic alkali oozes through to the outer surface of this together with the hydrogen evolved, a current of oil regulated by a baffle plate set close to the asbestos layer covering the cathode, is made to rapidly circulate in a vertical direction, due to the evolution and rise of the bubbles of hydrogen. The anode solution is also caused to circulate by the arrangement of the anode, which consists of a circular, hollow electrode of Acheson graphite, the anode solution rising next to the diaphragm in the same way that the cathode solution is caused to rise. The carrying away of the caustic soda is effected so rapidly that very little chlorine is taken up to form chlorate or hypochlorite. A few of a number of analyses given by the author show the relative freedom from this ingredient. L.

| Date. | Amp. | Cl, grams per liter. | $ClO_3$, grams per liter. | $ClO_3$, grams per liter. | |
|---|---|---|---|---|---|
| Aug. 14 | 1,000 | ...... | ...... | ...... | Start 3.30 p.m. |
| " 21 | 1,000 | 0.41 | 0.091 | 0.0 | Analy'd Aug. 23. |
| " 26 | 1,200 | 1.02 | 0.154 | 0.368 | |
| Sep. 7 | 1,200 | 0.38 | 0.07 | 0.144 | Analy'd Sep. 12. |

The samples of gas analyzed showed 99.7 to 99.8 per cent. chlorine, while the caustic efficiency was about 99.6 per cent. of the theoretical. S. P. SADTLER.

**An Electrolytic Switch.** BY WILLIAM SMITH HORRY. *Electrochem. and Metal. Ind.*, May, 1905.—In this arrangement there is connected in the circuit a cell containing aluminum electrodes, so that the increased voltage formed at the current-break is taken up by the cell. In this way sparking is avoided. The insulation of this cell is periodically broken down and reestablished.

S. P. SADTLER.

**Spray Nozzle for the Injection of Water into the Chambers of Sulphuric Acid Plants.** *Chem. Eng., May, 1905.*—Descriptions and cuts are given, showing the use of nozzles for injecting cold, mechanically vaporized water into sulphuric acid chambers, instead of steam. S. P. SADTLER.

**Design and Construction of Small Chemical Laboratories.** SUBJECT: BALANCE SUPPORTS. *Chem. Eng.*, April, 1905.

**Design and Construction of Small Chemical Laboratories.** SUBJECT: HEATING APPLIANCES FOR THE USE OF CITY GAS. *Chem. Eng.*, May, 1905.

**Design and Construction of Small Chemical Laboratories.** SUBJECT: APPARATUS FOR ELECTROCHEMICAL ANALYSIS. *Chem. Eng.*, June, 1905. S. P. SADTLER.

**Notes on Apparatus for Laboratory Blast and Suction.** BY PORTER W. SHIMER, PH.D. *Chem. Eng.*, April, 1905.—The author describes the use of two large cylinders, such as household boilers, in connection with a combined air pressure and vacuum pump operated by hand. This is recommended for laboratories not connected with power-pumps or good water pressure.

S. P. SADTLER.

**Boiler Waters and Their Treatment.** BY WM. M. BOOTH, B. S. *Chem. Eng.*, April, 1905.—With regard to chemical water-softening within the boiler, various compounds used, as described in patents and formulae given in encyclopedias, are given, the main, and probably most important active constituents in all these, however, being tannin, soda-ash, dextrin, molasses and starch-containing materials. Glycerol is also given as it is supposed to increase the solubility of calcium sulphate, as the water

evaporates. The discussion of the materials used is then given. Caustic soda and soda-ash in excess cause foaming. The use of tannin and its salts is condemned, due to the attack upon the iron of the boiler, which the tannin does as well as removing scale. Vegetable compounds such as dextrin, are disadvantageous, because of their coating the tubes, and thereby causing reduced efficiency in the fuel. Molasses is generally found to be acid. Soda-ash and caustic soda are regarded as harmless to the metal of the boiler. The only difficulty attending the use of trisodium phosphate and sodium fluoride, is the fact that the cost is several hundred per cent. greater than soda-ash. The author states that all money paid in excess of 3 cents per thousand gallons for softening water is unjustifiable. Soda-ash alone in regulated amount should answer all requirements in limestone and shale regions. For plants of 75 to 150 horse-power, twenty-four settling tanks are recommended. For plants with a boiler capacity of 500 horse-power or above, a water-softening system is recommended. In this way the water-softening is rendered continuous. Tests were made by the author upon uniform drillings from mild steel to which distilled water, Syracuse water, Cortland water, a solution of tannic acid, a slightly alkaline solution of sodium tannate, of about decinormal strength, distilled water and monohydrate crystals, decinormal caustic soda, Syracuse water, containing lubricating oil with 10 per cent. of vegetable oleins present. The results were as follows:

(1) Metal very badly corroded.
(2) Syracuse water, an equal amount, permanently hard.
(3) Cortland water, temporarily hard.
(4) So badly corroded in color that filings could hardly be seen in the solution.
(5) Of about the same degree of corrosion as the previous case.
(6) Clear, scarcely acted upon.
(7) Decinormal NaOH, a white flocculent precipitate.
(8) Medium corrosion.

As a result of letters written by the author to large manufacturing concerns, as to their methods of softening water, most of them referred to the combined use of lime and soda as satisfactory for the purpose of softening, and the three things most generally mentioned were lime, soda-ash and trisodium phosphate. Pure distilled water itself, or rain water, cannot be used for boiler purposes without the addition of a small amount of lime. Air and other dissolved gases found in water cause severe corrosion.

S. P. SADTLER.

**A Brief Outline of Gas Works Chemistry.** BY H. B. HARROP, B.Sc., M.D. *Chem. Eng.*, June, 1905.—A general introduction of the subject is given, describing various hydrocarbons of the several series, and then the origin of coal is mentioned, in

which the author says that it is generally believed that coal is the residue from prehistoric vegetation, acted upon by high temperature in the presence of moisture and pressure, and that peat, brown coals (lignite), bituminous coal, anthracite and graphite are supposed to represent successive stages in a gradual transformation. Discussing the impurities of coal and its distillation, the oxygen contained forms water with hydrogen and then with carbon to form oxides of carbon, phenols and minor oxygenated compounds. The nitrogen contained produces free nitrogen, ammonia and cyanogen, and other nitrogenous bodies which are found in the coke, tar and gas. A part of the sulphur combines with carbon, a part with hydrogen, and jointly with both, while a portion of it remains in the coke in mineral combination. About 14 per cent. of the nitrogen in the coal is given as being evolved in the form of ammonia. The author gives the following as the distribution of sulphur in the various products:

| | |
|---|---|
| Coal .......... 2,000 lbs. at 1.09 per cent. S. | 21.80 lbs. |
| Coke .......... 1,400 lbs. at 0.78 per cent. S. | 10.92 |
| Ammonia liquor .......... 427 lbs. at 0.20 per cent. S. | 0.85 |
| Sulphur left in boxes .......... | 8.00 |
| Tar .......... 131 lbs. at 0.76 per cent. S. | 1.00 |
| Purified gas, 9.640 ft. at 32 gr. S. per 100 ft .......... | 0.44 |
| Unaccounted for .......... | 0.59 |

In the proximate analysis of coal, the author suggests that the flame of the Bunsen burner be long and full so that a luminous point just appears at the apex, which means that the flame contains no excess of free oxygen. The crucible is then bathed entirely with the flame. When the volatile matter ceases to issue from under the crucible lid, the burner is timed so that it remains just one minute when the crucible is cooled and promptly weighed. The author speaks of determining the sulphur in the cartridge of the Parr calorimeter. S. P. SADTLER.

**Notes on Softening of Iowa Well Waters.** BY NICHOLAS KNIGHT, A.M., PH.D. *Chem. Eng.*, June, 1905.—In his experimentation the water was taken with the following composition as given in the first column:

| | Amount taken. | Evaporated on boiling. 10 cc. | 45 cc. | 70 cc. |
|---|---|---|---|---|
| Total solids in platinum dish | 28.86 | 23.38 | | |
| $CaCO_3$ .......... | 12.47 | 9.27 | 4.92 | 4.25 |
| $MgCO_3$ .......... | 10.42 | 9.53 | 9.75 | 8.52 |
| $CaSO_4$ .......... | 0.989 | 0.98 | 0.98 | 0.98 |
| $SiO_2$ .......... | 2.12 | 1.68 | 1.78 | 1.66 |
| $Fe_2O_3$ and $Al_2O_3$ .......... | 0.266 | 0.25 | 0.32 | 0.27 |
| NaCl and KCl .......... | 2.34 | 2.34 | 2.34 | 2.34 |
| | 28.60 | 24.05 | 20.09 | 18.62 |

To show the effects of boiling on precipitating the calcium and magnesium carbonates, the analyses of the same are given. In the first, 10 cc. of water out of 500 cc. taken, were evaporated during boiling. In No. 2, 45 cc. were evaporated, and in No. 3, 70 cc. were evaporated. To show the influence of lime-water on calcium and magnesium carbonates where the lime-water was put in with the use of phenolphthalein as an indicator, the following analysis of the same water is given:

| | |
|---|---|
| $CaCO_3$ | 2.41 |
| $MgCO_3$ | 4.13 |
| $CaSO_4$ | 0.98 |
| $SiO_2$ | 2.12 |
| $Fe_2O_3$ and $Al_2O_3$ | 0.26 |
| NaCl and KCl | 2.34 |
| | 12.24 |

To give the effects of boiling under pressure, a small autoclave or boiler was used, designed and constructed by Mr. Frank L. Hann, which consisted of a 5-inch gas pipe closed at the ends with heavy caps, into which were inserted a blow-off, a pressure gauge, a stop-cock for removal of liquid, and in the pipe itself an aperture for the insertion of a thermometer was tapped. With a temperature at about 150° C. and with pressure from 90 to 100 pounds, the following comparison is given:

| | Boiled water. | Raw water. |
|---|---|---|
| Total solids in platinum vessel | 16.52 | 30.58 |
| $CaSO_4$ | 3.43 | 3.43 |
| $CaCO_3$ | 3.90 | 12.65 |
| $MgCO_3$ | 4.61 | 10.69 |
| $SiO_2$ | 1.70 | 1.70 |
| $Fe_2O_3$ | 0.18 | 0.18 |
| NaCl and KCl | 2.70 | 2.70 |
| | 16.52 | 31.35 |

On another sample of the water, drawn from the same source at a different time, a comparison of the action of simple boiling is given:

| | Raw. | Boiled. |
|---|---|---|
| Total solids in platinum dish | 28.86 | 19.18 |
| $CaSO_4$ | 0.98 | 0.98 |
| $CaCO_3$ | 12.47 | 4.25 |
| $MgCO_3$ | 10.42 | 8.52 |
| $SiO_2$ | 2.12 | 1.66 |
| $Fe_2O_3$ | 0.26 | 0.27 |
| NaCl and KCl | 2.34 | 2.34 |
| | 28.59 | 18.02 |

It will be noticed that the amount of calcium carbonate whether boiled under pressure, or with 6 or 7 atmospheres, is about the

same, while the precipitation of magnesium carbonate is increased. Boiling for twenty minutes at normal pressure removes 44 per cent. of the temporary hardness, at the increased pressure, 63.5 per cent. The calcium sulphate, it may be noted, is not affected by pressure. S. P. SADTLER.

**The Analysis of Raw Wool.** BY J. MERRITT MATTHEWS, PH.D. *Textile Colorist*, April, 1905.—Dirt or matter insoluble in water, is obtained by steeping 10 grams of carefully sampled wool in 250 cc. water at 120° F., filtering, washing and igniting the residue to ash, which is considered by the author to represent dirt. Soluble constituents are determined by difference, after determining the wool itself by steeping in water at 120° F., squeezing and washing the dirt and the grease. The amount of potassium carbonate is obtained from the soluble portion by igniting the potassium combined in the suint as potash soap to carbonate and weighing. The grease is determined by saturating 10 grams of wool with 150 cc. of petroleum ether in a flask for a half hour. The solution is then poured through a filter and weighed in a tared dish. S. P. SADTLER.

**Gas Producer Power Plants.** BY SAMUEL S. WYER. *Bull. Am. Inst. Min. Eng.*, May, 1905.—Five conditions given as reasons why gas-producer power plants have received so little attention in America, may be attributed as follows:

(1) *Ignorance and prejudice*, due to fragmentary character of the literature and lack of reliable data available to engineers.

(2) *Newness of work*: As the gas-producer and the gas-engine have both been developed to a high state of efficiency, there is nothing experimental in the consideration. A list of installations in America is given.

(3) *Inadaptability of gas engines*: The gas-engine must suit the particular gas available, as an engine that will develop 100 horse-power with one gas, may only give 80 horse-power with another.

(4) *Fuel economy has not been imperative.*

(5) *Smoke nuisance.*

*General Data.*

Some of the problems given by the author are referred to here:

(2) *Labor.* The cost is about the same as for a steam-plant of similar size, but when idle requires less attention. It is very easily arranged for emergency demands, such as for pumping water for city fires.

(3) *Cost of installation.* The following is quoted from two well-known engineering concerns: "The cost of gas-power plants, including gas generating plant and gas-engines up to 500 horse-power, is about 20 per cent. higher than the cost of a steam plant of similar size. Large plants, from 1,000 horse-power upwards, cost about the same as a first-class steam plant of similar size."

(4) *Cost of repairs*, about the same.

(5) *Use of cheap fuels*. This is generally possible when it does not contain too much sulphur.

(6) *Scrubbing the gas*. It is best done by passing the gas through red hot coals.

(7) *Fuel economy during hours of idleness*. The only loss being due to radiation, as air inlets are tightly closed.

(8) *Time required to start producers*. Can be brought to full capacity in fifteen minutes.

(11) *Thermal efficiency*. Generally about 80 per cent.

(12) *Automatic feeding*. Much easier than with a steam boiler on account of the vertical position.

(13) *Rate of gasification*. About 12 pounds of coal per square foot of grate area per hour.

(15) *Calorific value of producer*. Varies from 125 to 150 B. T. U. per cubic foot.

(16) *Economy*. 1 to 1.25 pounds of coal or 3 pounds of wood for one brake horse-power and the gas contains at least 80 per cent. of the heat-energy resident in the fuel.

(17) *No loss from condensation*.

(18) *Leakage of gas*. Very slight, due to low pressure of gas.

(20) *Floor space*. About the same as in steam plant.

(21) *Control of operation*. Better.

(22) *Storing of heat energy*. In gas holders.

(23) *Dual use of gas*. For both power and metallurgical purposes.

(24) *Economy of water*.

(25) *Operation of isolated machines*. Gas can be piped.

(26) *Range of sizes*. Standard sizes from a few horse-power to 500 horse-power.

Gas producers are to be recommended for locomotives, portable engines, and marine use on the score of economy, absence of cinders, being smokeless, safety, etc. S. P. SADTLER.

**The Learned Insulated Pipe Joint.** *Am. Gas Light Jour.*, May, 1905.—A detailed description with drawings of the mechanical arrangement of the joint is given. The lute used in the joint is made as follows:

The residue from the distillation of coal tar boiling above 530° to 550° F. is mixed at a temperature of about 330° F. with a rosin soap made up of equal parts of air-slaked lime and powdered rosin. The rosin soap and pitch are mixed in the following approximate proportions: Pitch, 72 parts; rosin soap, 28 parts. This compound is said to be slightly yielding to correspond with slight movements of the pipe sections. S. P. SADTLER.

## AGRICULTURAL CHEMISTRY.

**Composition and Digestibility of Distillers' Dried Grains.** By ALVIN K. RISSER. *Report of Pennsylvania State College*, 1903-1904, p. 221.—This article discusses the source and character of distillers' grains, and includes a compilation of American and German analyses of grains of different character. It also includes the results of the feeding experiments conducted by the author, and the results of the analytical work attending those experiments. The writer concludes, after comparative study with other feeds, that these grains as a source of proteins rank well with a number of our best feeding stuffs in the amount of digestible matter contained. "In the amount of digestible matter contained, distillers' dried grains compare quite favorably with the feeding stuffs enumerated, and in conclusion it may be said that in buying protein foods, feeders will do well to give these grains equal consideration with other foods rich in protein."

W. D. BIGELOW.

**Manufacture of Cognac Brandy.** By GEORGE H. JACKSON. *Daily Consular Report for June* 19, 1905, p. 3.—The report consists of a somewhat detailed description of the methods employed in the manufacture of cognac brandy, and defines the terms used in the industry.

W. D. BIGELOW.

**Facts and Fallacies Concerning Brandy.** By GEORGE H. JACKSON. *Daily Consular reports for June* 8, 1905, p. 4.—The writer states that there is a commerce between the United States and France in what might be called "split brandy," which is a mixture of pure brandy and industrial alcohol. At the same time, he believes that a very large proportion of the cognac brandy received in the United States is manufactured exclusively by the distillation of wine. He also discusses briefly the theories regarding the change in composition of brandy, due to ageing.

W. D. BIGELOW.

**Examination of Spices.** By WM. FREAR, H. L. WILSON AND R. E. STALLINGS. *Report of the Pennsylvania State College*, 1903-1904, p. 137.—The report gives the analysis of six varieties of ginger, five varieties of black pepper, and two varieties of white pepper of known origin, for the purpose of determining the applicability of the food standards adopted by the U. S. Department of Agriculture. All the samples examined, with the exception of one sample of Lampong black pepper, were found to comply with the standards. The article also includes the analyses of two series of samples of black pepper (Acheen and Lampong) taken at different stages in the milling. The color of the first milling products was almost as white as white pepper, while the last was very dark and probably composed chiefly of hulls. From the analysis

given it is apparent that as the milling of a given quantity of pepper progresses, the ash increases, while the percentage of ash insoluble in acid decreases. The first and whitest product contains as much ash as any other portion except the last and has more insoluble ash, that is, sand and clay, than any other portion. The last portion, on the other hand, though highest in total ash, due to the excess of hull, is exceedingly free from sand and clay. The composition is also given of a set of pepper samples, representing respectively the first skin and third skin of the whole pepper. These analyses show the ash to be most abundant in the outer skin, and the almost entire absence of acid-insoluble ash from the inner layer. The extract and piperine in the outer skin were found to be much lower than the whole berry, but the quantity in the first skin was found to be very similar to those in the entire berry. W. D. BIGELOW.

**Digestion Experiments.** BY J. B. LINDSEY. *Seventeenth Annual Report of the Mass. State Experiment Station.*—The work that has been conducted by the author for a number of years is continued, old and young sheep being used for the experiment. The feeds used consisted of a number of the ordinary farm crops as well as a set of commercial stock feeds. Of special interest is the experiment of the author to determine the digestibility of galactan. "The galactan in the hay is shown to be 75 per cent. digestible. Because of the small quantity present, the results are of minor importance. All three sheep digested the galactan in the clover seed quite thoroughly. Such a result was to have been expected, for the reason that in the seed the galactan is supposed to be comparatively free from incrusting substances, which have been shown by various investigators to seriously interfere with the digestibility of the several fodder groups. Naturally, no positive conclusions should be drawn from the present single investigation. Knowing, however, the physiological and chemical character of the galactan, as well as the digestion coefficients obtained with starch and with the pentosans, bodies of similar character, it is reasonably safe to conclude that the results secured give a fairly correct idea of the ability of the animal to utilize the galactan group." The composition and digestibility of two samples of apple pomace were also determined. "The results show the total dry matter in apple pomace to be about as digestible as in the best grades of silage. The protein content of the pomace is small—about 1 per cent.,—and it has not been possible by present methods to fix its digestibility. Judging from the composition and digestibility of the pomace, one would feel justified in assuming that pound for pound, it should approach in feeding value an average quality of corn silage." W. D. BIGELOW.

**Food Inspection.** *Maine Agr. Expt. Station, Bull.*, 116.—

This bulletin contains the standards for animal and vegetable products as adopted by the pure food law enacted in Maine in 1905.

J. A. LeClerc.

**Influence of Nodules on the Roots upon the Composition of Soy Beans and Cow-peas.** *Mich. Agr. Expt. Station Bull. 24.* By C. D. Smith and F. W. Robinson.—The authors noticed that although their inoculated plots did not produce any larger yield than those not inoculated, yet the crop from the former plots was materially richer in protein than that of the latter; *e. g.*, soy beans, gave the following results, as the average of crops in 1903–4.

| | Ash. | Protein. | $P_2O_5$. | $K_2O$. |
|---|---|---|---|---|
| Leaves and stems (with nodules)...... | 8.8 | 17.4 | 0.60 | 2.1 |
| (without nodules) | 9.1 | 11.1 | 0.61 | 2.0 |
| Roots (with nodules)........................ | 6.9 | 6.3 | 0.38 | 1.1 |
| (without nodules) .................. | 8.4 | 9.0 | 0.35 | 0.86 |

Analyses of cow-peas gave similar results, showing that although the crop may not be any larger when inoculated yet it is much more valuable either for feeding or for plowing under. The ripe soy bean seed produced on the inoculated plots contained about one-sixth more protein than that on the uninoculated, but the amount of fat, fibre and ash was about the same in each case.

J. A. LeClerc.

**Shrunken Wheat for Swine.** *S. Dak. Agr. Expt. Station Bull. 90.* By James H. Wilson and H. G. Skinner.—Wheat weighing 57 pounds per bushel, and rusted wheat weighing only 44 pounds per bushel were fed to swine, the former yielding 1 pound gain for every 3.8 pounds wheat fed against 4.2 pounds rusted wheat. Analyses of both samples showed a lower protein content but a much higher crude fibre and nitrogen-free-extract content in the rusted wheat.

J. A. LeClerc.

**The Camembert Type of Soft Cheese in the United States.** *Storrs Agr. Expt. Station Bull. 35.* By H. W. Conn, Chas. Thom, A. W. Bosworth, W. A. Stocking, Jr., and T. W. Issajeff.—The object of this bulletin is "to learn the details of the methods of manufacturing some of the soft cheeses;" and to study the process of ripening and the chemical changes involved therein. The conclusions reached are that the ripening of Camembert cheese is the result of the activity of molds and bacteria, one mold (*Penicillium candidum?*) producing the principal changes in the curd, giving it the desired texture, whereas *Oidium lactis*, another mold, acting in connection with the former, gives the flavor. The required acidity of the curd is produced by lactic bacteria, used in the starter. No other organisms appear to be absolutely essential for the production of the texture and flavor of Camembert

cheese. The process of ripening may be quite uniformly controlled. Authors discuss different types of cheese, especially hard and soft cheeses, the difference between them at the start being the larger amount of whey, and consequently water, which the latter contain. This high content of water produces conditions favorable for the growth of organisms, which develop the high flavors characteristic of them. The cheese ripens in a few weeks, the chemical changes going on very much more rapidly than in hard cheeses. The ripening of Camembert cheese is discussed, illustrations being used in showing differences between improperly ripened and well-ripened cheese. After discussing the mycology and the bacteriology of Camembert cheese, the authors take up the chemical side of the ripening, showing that they worked chiefly upon the nitrógenous constituents, the fat being considered as of secondary importance in the ripening and development of flavor. During the first twelve days, the principal change in the cheese is the development of acid from the sugar. Then the curd gradually softens and changes from an insoluble lump to a creamy mass almost entirely soluble in water. This change, starting from the outside and working toward the centre, is due to the activity of enzymes produced by the molds which grow on the cheese.

The following table shows the chemical changes with regard to the nitrogenous constituents:

| Age. | Per cent Total N. | Monolactate N. | Water-soluble N. | Amido N. | $NH_3$ N. |
|---|---|---|---|---|---|
| 1 day | 2.73 | 0.40 | 0.32 | 0.23 | 0.00 |
| 10 days | 2.81 | 0.67 | 0.73 | 0.38 | 0.00 |
| 11 " | 2.92 | 0.62 | 0.75 | 0.61 | 0.00 |
| 12 " | 2.90 | 0.63 | 0.69 | 0.53 | 0.00 |
| 20 " | 2.90 | 0.17 | 1.85 | 0.42 | 0.06 |
| 28 " | 2.61 | | 2.09 | 0.46 | 0.21 |

J. A. LeClerc.

**The Germination of Seeds.** By A. Nilson. *Am. Brew. Rev.*, March, 1905.—The author previously showed that the germination of barley seed was dependent upon the activity of the acid-producing bacteria found on the outer coating of the barley grain. This conclusion was based upon the facts: (1) "That barley will germinate when steeped in 0.2 to 0.4 per cent. solutions of sodium hydroxide. (2) "Barley will not germinate when steeped in water saturated with toluene." This view being combatted, the author sought to prove the correctness of his conclusions by applying the same treatment to other seeds *e.g.*; the honey locust, vetch, and clover, from the results of which it was found that these seeds can germinate independently of any bacteria; "that an alkaline condition of endosperm or cotyledon makes germination impossible, and that

toluene does not prevent germination." From results with the above seeds it follows that inasmuch as toluene does not kill the germ or prevent germination, the reason why barley seed did not germinate in toluene solution is that germination in this case is dependent on the activity of bacteria, as previously asserted. The author concludes; "the poorly protected germ and endosperm of the barley do not contain *free* enzymes in sufficient quantity to make germination possible, and that the enzymes are set free first by the chemical action of the acids produced by the living bacteria of the barley corn, which bacteria, in exchange for the soluble carbohydrates and albuminoids extracted by the steeping water from the barley, send back into the germ and endosperm the lactic acid which dissolves the insoluble albumen and thereby sets free the enzymes."

J. A. LeClerc.

**Dust Spray in Delaware.** By C. P. Close. *Delaware Agr. Expt. Sta. Bull. 69*, Part I.—Results are given of experiments made during 1904 with dust sprays to determine their efficiency as compared with liquid sprays. By mixing copper sulphate, Paris green or lead arsenate, and hydrated magnesia lime, a very satisfactory dust-spray was obtained, and the cost of applying was materially less than in case of the liquid sprays. It is the author's opinion that for certain insects and diseases the spray will largely replace the liquid spray in the future.

L. S. Munson.

**Blossom Food Preparations.** By Capt. J. E. Bloom, U. S. A. —The author proposes to so manufacture oils for edible purposes, and so modify the fats of various food preparations that the resulting oils or fats will be of a predetermined composition, approximating that of human fat. The human fat of an adult was found to contain olein 86.21, palmitin 7.83, and stearin 1.93, while that of a child was found to contain olein 65.04, palmitin 27.81, and stearin 3.15. The author states that when fatty matter of the above composition is supplied as a food, it is the more easily digested and more completely assimilated. An oil of approximately the desired composition is obtained by compounding natural oils, either of vegetable or animal origin, the proportion of olein, palmitin and stearin of which have been determined, or by compounding approximately pure olein, palmitin, and stearin. The author states a preference for the use of olein, palmitin and stearin prepared synthetically, but gives no methods by which the tri-glycerides are prepared on a commercial basis. The fat of food preparations is modified by first extracting a portion of the fat, and then adding in its stead the amount of olein, palmitin or stearin, or two or all of these necessary to give the resultant fat the proper composition. L. S. Munson.

**Preparation and Use of Sprays.** By William Stuart. *Vt. Agr. Expt. Sta. Bull. 113.*—The bulletin gives concise directions for controlling the commoner diseases and insects attacking Vermont crops by use of fungicides, insecticides, and other preventive measures, and gives directions for preparing and applying the commonly used fungicides and insecticides. L. S. Munson.

**Constants of Persimmon Seed Oil.** By N. J. Lane. *J. Soc. Chem. Ind.*, 1905, **24**, 390.—This oil is semi-drying, brownish yellow in color, and tastes and smells like peanut oil produced by heat. The following constants were determined: Specific gravity (at 15° C.), 0.9244; saponification value, 188.0; iodine value (Hübl method), 15.6; Hehner value, 95.9; acetyl value, 2.15; solid fatty acids, 9.11 per cent.; liquid fatty acids, 65.50 per cent. The oil contains no arachidic acid. L. S. Munson.

**Spraying for Scale Insects.** By H. J. Quayle. *Cal. Agr. Expt. Sta. Bull. 116.*—The author gives results of experiments on the dilution, and the variation of the constituents of the lime-sulphur-salt wash used for San José scale, and suggests methods for the preparation and application of this wash. With brown apricot scale the lime-sulphur-salt wash proving inefficient, a resin compound was used instead. Results are given of experiments on dilution, and of the use of various ingredients in the compound. L. S. Munson.

**Notes on Analysis of the Water from the Manila Water Supply.** By Chas. L. Bliss. *Report Bureau of Govt. Laboratories.*—Results are given of a chemical and biological investigation extending over a period of seven months, of the Manila water supply. Despite a great variation in weather conditions during the period the analytical results showed no wide variation, and bacteriological examination showed the presence of a relatively small number of bacteria, none of which were pathogenic. There were present, however, almost constantly amoebas, which are considered dangerous factors of disease. L. S. Munson.

**The Water Soluble Plant Food of Soils.** By Harry Snyder. *Minn. Agr. Expt. Sta. Bull. 89.*—To determine the ability of water-soluble plant food of soils to support crops, sterile sand was leached with dilute acid, washed and ignited, and 100 mg. of $CaCO_3$ per kg. of sand added. Oats, wheat and barley were grown in pots in this sand and supplied only with such food as was contained in water leachings of a fertile soil. Check experiments with the fertile soil watered with distilled water were conducted. Plants in the fertile soil made normal growth while those in the sand suffered. The amount of plant food supplied to each pot containing sand (as determined at the end of the experiments in a

composite sample of the fertile soil leachings used) is given with other data.

| | Plant food supplied. | Grown in sand with soil leachings. Wheat. | Oats. | Barley. | Grown in normal soil. Wheat. | Oats. | Barley. |
|---|---|---|---|---|---|---|---|
| Number of plants | | 16 | 16 | 12 | 16 | 16 | 12 |
| Dry matter, gms. | | 2.14 | 4.83 | 6.15 | 7.05 | 8.65 | 11.75 |
| Nitrogen " | 0.3125 | Not determined. | | | 0.1537 | 0.1424 | 0.2639 |
| Phos. acid " | 0.0937 | ..... | 0.0396 | 0.0320 | 0.0534 | 0.1374 | 0.0860 |
| Potash " | 0.5000 | ..... | 0.1063 | 0.0836 | 0.1661 | 0.2084 | 0.2116 |

The author concludes that "it is quite evident that soil leachings fail to furnish a sufficient amount of available plant food to produce a normal crop of wheat, oats or barley. . . . ." The amount of water used on the sand was from 6 to 18 times as much as the usual rainfall. F. P. VEITCH.

**The Growth of Crimson Clover.** BY CHAS. L. PENNY. *Del. College Agr. Expt. Sta. Bull. 67.*—The purpose of the experiment was to determine whether crimson clover in the early spring growth contains much less nitrogen than at maturity. It was found that the yield of nitrogen 30 days before bloom ranges from $^1/_2$ to $^{14}/_{15}$ of the yield at full bloom and about 35 per cent. is contained in the roots and stubble. The amount of potash usually increases during the last 30 days before bloom, and the roots average about 17 per cent. of the total quantity taken up by the plant. The amount of potash taken up varies greatly, ranging from 63 to 183 pounds per acre. The total phosphoric acid taken up varies from 11 to 38 pounds per acre. F. P. VEITCH.

**Analyses of Commercial Fertilizers.** *S. C. Agr. Expt. Sta. Bull. 94.* F. P. VEITCH.

**Commercial Fertilizers.** *Purdue Univ. Agr. Expt. Sta. Bull. 106, Vol. XII.*—The bulletin contains the state fertilizer law, the estimated quantity of fertilizer sold throughout the state, analyses of samples collected in 1904 and a list of registered brands. F. P. VEITCH.

**Notes on Testing Soils for Application of Commercial Fertilizers.** BY H. A. WEBER. *V. Internat'l Kong. angew. Chem., Bericht III.*—An application of standard methods of pot experiments to the determination of the needs of the soil. F. P. VEITCH.

**Fertilizers.** BY J. P. STREET. *V. Internat'l Kong. angew. Chem., Bericht III*, 905.—A brief review of the work of American investigations on methods of analysis, composition, availability, nitrification and denitrification, manufacture and use and relative value of the different fertilizers upon different soils. F. P. VEITCH.

**The Analyses of Stone Lime, Prepared Lime, Oyster Shell Lime, Wood Ashes and Marl.** By L. A. Voorhees. *N. J. Agr. Expt. Sta. Bull. 183.*—General popular discussion with analyses of various kinds of lime and their weights, prices and uses. Prepared limes which cost more than ordinary limes, are in many instances not as good as ordinary agricultural limes. In other instances the prepared limes contain both potash or phosphoric acid and nitrogen. F. P. Veitch.

**A New and Valuable Cover Crop for Tobacco Fields.** By A. D. Shamel. *Conn. Agr. Expt. Sta. Bull. 149.*—The Russian vetch is strongly recommended, but no data appear to have been obtained other than that the plants stood the severe winter of 1904–1905. F. P. Veitch.

**Observations on the Fertilization of Peach Orchards.** By E. H. Jenkins. *Report Conn. Agr. Expt. Sta. Part V.*, p. 444.—Complete data are given of an experiment begun in 1896. Discussion of the results is reserved. So far, the plots receiving the largest amounts of potassium sulphate in conjunction with acid phosphate have lost the fewest trees and given the highest average yield of fruit per tree. F. P. Veitch.

**Studies of Muck and Peat Soils.** By A. R. Whitson and C. W. Stoddart. *21st Ann. Report Wis. Agr. Expt. Sta.*—The marsh soils of the state are classed as muck and peat. The former is a true marsh soil while the latter is more properly a moor soil. These two classes show marked differences in physical and chemical properties. In general the vegetable matter of the marsh soil is partly decayed, while in the moor soils the vegetable matter is in the form of peat. Fertilizer experiments indicate that the marsh soils are deficient in potash and are not markedly acid. Preliminary experiments on the peat soil indicate a deficiency of both phosphoric acid and of potash. These soils are very acid, requiring 3642 parts of lime per million to neutralize a soil from Marinette according to Wheeler's modification of Tacke's method. Experiments with unlimed, partly neutralized, neutralized soils and soils made alkaline with lime did not show benefit from liming with corn or oats. Field experiments with grasses, corn and potatoes also showed no benefit. On the other hand, the total amount of nitrate developed during the season increased, with the increase in amount of lime applied. F. P. Veitch.

**Analyses of Commercial Fertilizers.** *Bulls. 112 and 113, S. C. Agr. Expt. Sta.*

**Analyses of Cotton-seed Meals.** *S. C. Agr. Expt. Sta. Bull. 105.*—The bulletin gives fertilizer analysis of a number of cottonseed meals. The average percentage of ammonia found was 7.52 per cent.

**Commercial Fertilizers.** BY J. L. HILLS, C. H. JONES AND F. M. HOLLISTER. *Vt. Agr. Expt. Sta. Bull. 112.*—The bulletin contains a list of manufacturers complying with the fertilizer law, analyses of samples and average analysis of samples of various brands for the past five years. F. P. VEITCH.

**Inoculation for the Growth of Legumes.** BY F. T. SHUTT. *Report Dominion Expt. Farms.*—Experiments and observation lead to the conclusion that red clover and alfalfa bacteria are quite generally distributed throughout Canada, and that only exceptionally will inoculation be found necessary. Inoculation with soil is regarded as more certain than with cultures.

F. P. VEITCH.

**How Can We Maintain the Fertility of Our Colorado Soils?** BY W. P. HEADDEN. *Colo. Agr. Expt. Sta. Bull. 99.*—In a general consideration of the subject the author discusses the origin of soils, relation of climate to fertility and the possibility of economically using commercial fertilizers in Colorado. The author thinks it probable that transportation charges and dealers' profits will render the use of fertilizers unprofitable, and the importance and economy of using barnyard manure and alfalfa as a green manure are strongly urged. F. P. VEITCH.

**Analyses of Miscellaneous Fertilizer Materials.** BY M. S. MCDOWELL. *Rept. Pa. State College, 1903–'04, p. 124.*

F. P. VEITCH.

**Nitrogen in Gums.** A. B. STEVENS. *Am J. Pharm.*, 77, No. 6, 255.—The author has examined a number of gums of various kinds and has found that all of them possess in greater or less degree the properties of enzymes and that there is no known means of separating the enzymes completely from the gum. Qualitative tests show that all the gums examined contained nitrogen which is converted into pyrrol or a pyrrol derivative by treating with potassium hydroxide, but all attempts to convert the nitrogen into cyanide failed. Unfortunately no quantitative results on nitrogen are given. F. P. VEITCH.

**Ohio Soil Studies I.** BY A. D. SELBY AND J. W. AMES. *Ohio Agr. Expt. Sta. Bull. 150.*—This is the first of a series of "Studies" and considers the composition, both mechanical and chemical, of the soils under experimentation. These soils are from the station farm at Wooster, from the State University farm at Columbus, and from the test farms located at Strongsville, Neapolis, Germantown and Carpenter. The geological formation of the soils is given and its effect upon the mechanical composition is discussed. In the chemical analysis, the ten-hour hydrochloric acid digestion method, as adopted by the Association of Official Agricultural Chemists, was employed.

The results are calculated and tabulated in various ways in order to bring out the relations which the authors wish to show. A discussion of all results, both mechanical and chemical, to bring out their relation to the fertility of these soils follows, and a brief discussion of the effect of biological reactions upon soil fertility is included. J. H. PETTIT.

**Investigation in Soils Management.** BY PROF. F. H. KING. *Bureau of Soils, U. S. Dept. of Agr., Bull. 26.*—This bulletin contains three of six papers submitted by Professor King in his report as Chief of the Division of Soil Management in the Bureau of Soils, (1901-1903); the other three papers—"Absorption of Water-soluble Salts by Different Soil Types," "Influence of Farmyard Manure upon Yields and upon Water-soluble Salts of Soils" and "The Movement of Water-soluble Salts in Soils"—have been published by Professor King from Madison, Wisconsin, and were recently reviewed in this Journal.

In Part I.—"Plant food recoverable from field soils"—the author states that "since the soil moisture is a nutritive solution, carried mechanically by, and reinforced from, the soil, and since variations in the composition, strength, and character of 'water-culture' solutions, have been found to materially influence growth, it is clearly of fundamental importance to establish:

(1) Whether, in soils of different types, the amounts and character of the readily water-soluble salts are measurably different.

(2) If these differences are in any way related to the needs of the crops to which the soils appear to be specially well adapted.

(3) If differences in yield are related, in any measurable way, to the amounts or character of the readily water-soluble salts of the soil.

(4) If recognized good and poor soil management does influence the water-soluble salts in such a way as to help explain the observed differences in yield.

(5) If crops themselves exert a differential effect upon the amounts of the essential ash ingredients carried in readily water-soluble form in the soil; and

(6) If the plant sap of crops, growing upon different soils, shows variations in strength and character which are related to the water-soluble salts in the soil and to the yields of crops upon them." After a review of the literature upon the composition of soil solutions and of drainage waters, as affected by different systems of soil treatment and management, the results obtained during the growing seasons of 1901-1903 are given. During the first season the acid radicals only, $NO_3$, $HPO_4$, $SO_4$, $HCO_3$, Cl and $SiO_3$, were determined; in 1903 the bases, K, Ca and Mg, were included. The methods used were those devised by the Bureau of Soils and published in Bulletin 22 of that Bureau.

Soils were sampled to the depth of four feet and separated into the first, second, third and fourth foot. During the first season the determinations were made upon the fresh soil; the second season the samples were oven-dried, which process increased the amounts of all salts, except chlorides, recoverable by distilled water. Several definite types of soil in different states were studied during the first season and the soil solutions, under good and poor crops growing on these types, were examined at intervals. During the second season the work was done largely upon eight soil types in four different states: the Norfolk sandy soil and the Selma silt loam at Goldsboro, N. C.; the Norfolk sand and the Sassafras sandy loam at Upper Marlboro, Maryland; the Hagerstown clay loam and the Hagerstown loam at Lancaster, Pa.; and the Janesville loam and Miami loam at Janesville, Wis. These eight soils represented marked differences in climatic conditions, and varied in their crop yields.

Part II shows the "Relation of Crop Yields to the Amounts of Water-soluble Plant Food Materials Recovered from Soils." Samples of the soil and of the crop were taken from twenty cotton fields on each of three soil types. The relative yields and salts recovered both by washing the soil and by the plants are shown in the table.

| | Goldsboro compact sandy loam. | Norfolk sandy soil. | Selma silt loam. |
|---|---|---|---|
| Relative size of yields | 1 | 237 | 275 |
| Relative amounts of salts recovered: | | | |
| By washing soil | 1 | 113 | 145 |
| By plants | 1 | 154 | 242 |

For several fields examined and for different crops the amounts of salts recoverable by distilled water from soil samples taken from the same field, were greater where the crop was better than where it was noticeably poorer. Upon each of the eight soil types mentioned in Part I, corn and potatoes were grown on two-acre areas separated by an area of fallow. Across each of these areas was one unfertilized plot, one plot having five, one ten and one fifteen tons of farm manure applied per acre, and one plot to which was applied three hundred pounds of guano per acre. This series of plots was repeated three times for each crop. The surface foot of soil was sampled every week from April until August 26; the second foot every other week, and the third and fourth feet, three times during the season. Samples of plants were also taken every week. The data obtained show "that the yields of both corn and potatoes have increased with the increased amounts of stable manure added, and, in the case of corn, somewhat proportionately to them; that the amounts of potash recovered from the sub-plots show the same order of increase that the yields of corn and potatoes show; that the amounts of

magnesia recovered follow the same general order of increase as do the potash and the crop yields; that the nitrates show little tendency to an orderly increase, the five-ton and fifteen-ton plots being the highest and the nothing added plots the lowest, as would be expected, but it is well established that nitrates in the soil decrease rapidly under vigorous growth; that the total salts show the same order of increase as the crop yields, except in the case of the guano plots; and that there is, roughly, a quantitative relation between the increase in the recovered amounts of total salts from the *manured* sub-plots, corresponding with that of the yields of corn from the same sub-plots." "In a broad way, too, it must be said of the two groups of soils—the four soils which have given low yields and the four which have given high yields—that every salt determined except chlorine shows a larger amount recovered from the soils which have produced the larger yields, and the contrast is so strong that such a relation must be conceded as existing in these particular soils."

Part III.—"Relation of Differences of Climatological Environment to Crop Yields"—contains the records of rainfall, sunshine, temperature, both of soil and air, soil moisture and evaporation on each of the eight soil types already mentioned. "Three series of temperature observations were made at each station: (1) Soil temperatures at 6, 12, 24 and 36 inches below the surface taken with Greene mercurial soil thermometers on the same dates, once weekly, at the four stations and on each soil type; (2) thermograph records of the soil temperature at one foot below the surface on each of the eight soil types; (3) thermograph records of the temperature of an unventilated metal shelter having its base three feet above the surface of the ground in one of the corn fields under experiment." Each station was supplied with two evaporimeters; in one the soil was kept stirred and free from plant growth, while in the second, ten corn plants were grown. An attempt was also made to show the possibilities of "dry-farming" on these eight soil types. All rainfall was excluded from an area four feet square and, from a second area, the capillary moisture as well was cut off at a depth of four feet. From these experiments "the only conclusion which it appears legitimate to draw is that the moisture relations came to be so prejudicial to growth that in no case could the development be even approximately normal. The plants, it is true, lived on and came to maturity, but they were small and most of them did not produce any ears at all." J. H. PETTIT.

**Contributions to Our Knowledge of the Aeration of Soils.** BY EDGAR BUCKINGHAM. *Bull. 25, Bureau of Soils, U. S. Dept. of Agr.*—"The object of this paper is to add to our information regarding the aeration of soils, primarily the escape of carbonic acid gas from its seat of formation in the soil and the

entrance of oxygen to take its place. The specific points treated are (1) The relative importance of diffusion and of changes in barometric pressure; (2) the influence of texture, structure, (or state of granulation) and compactness; (3) the actual amounts of carbonic acid leaving and of oxgyen entering the soil under different conditions of temperature, porosity and composition of the soil atmosphere. The experimental work deals (1) with the mixing of carbonic acid and air by diffusion through layers of soil of known area, thickness and porosity, when the total pressure is kept the same on both sides of the soil layer, and (2) with the rate of flow of air through the same layer of soil in precisely the same physical state under the influence of a slight excess of pressure on one side of the layer. This flow of air under pressure is similar to the flow or transpiration of air through capillary tubes." Here ensues a full description of the apparatus devised for the study of transpiration and diffusion. Porosity, transpiration constant and diffusion constant are defined and the mode of determining the same described. The experimental data are given in full together with some empirical conclusions to be drawn from them. In conclusion the author states:

(1) "We have measured the rate of flow of air under pressure by transpiration, and of air and carbonic acid by diffusion, through four widely different soils, in varying states of structure, compactness, and moisture content.

(2) We have shown that the speed of diffusion of air and carbonic acid through these soils was not greatly dependent upon texture and structure, but was determined, in the main, by the porosity of the soil.

(3) We have shown that the rate of diffusion was approximately proportional to the square of the porosity.

(4) We have shown that when this relation is used to compute from our results the rate of free diffusion when no soil is present, it gives a result which is entirely consistent with what is already known from the work of other experimenters on the free diffusion of gases.

(5) We have shown that when the porosity of a soil is reduced by compacting it, the ease with which air flows through it under the driving influence of a difference of pressure is greatly reduced, varying as the sixth or seventh power of the porosity.

(6) We have investigated the depth to which free outside air might penetrate soils of different depths, under such barometric variations as are to be expected in average cases, if the outside air remained distinct from the soil air.

(7) We have shown how to compute the rate of escape of carbonic acid from the soil by diffusion under different conditions of temperature, pressure, porosity and concentration of carbonic acid.

(8) We have compared the linear velocities of diffusion and arometric transpiration, and hence—

(9) We have shown that the escape of carbonic acid from the soil and its replacement by oxygen take place by diffusion and are determined by the conditions which affect diffusion, and are sensibly independent of the variations of the outside barometric pressure."

Some mathematical relations involved in the penetration of barometric waves into the soil and in the diffusion of two gases through a third are included in two appendices. J. H. PETTIT.

**Experiments in Growing Cuban Seed Tobacco in Texas.** BY GEORGE T. MCNESS AND WALTER M. HINSON. *Bureau of Soils, U.S. Dept. of Agr., Bull. 27.*—Observations made while collecting tobacco for exposition purposes brought out the fact that a very superior tobacco was being produced in some parts of Texas. Further study in connection with a survey of the soils in several of the tobacco localities showed that on a certian fine, sandy loam there was produced "a leaf of much finer aroma than the leaf of that grown on any other soil in the area." This tobacco "nearly equals the Cuban leaf in all of its qualities and surpasses any filler now being grown in the United States." The bulletin gives the results of several co-operative tests in growing, curing and marketing this tobacco, together with the opinion of manufacturers as to its possible commercial value. J. H. PETTIT.

**Soil Investigations.** BY HARRY SNYDER AND J. A. HUMMEL. *Minn. Agr. Expt. Sta. Bull. 89.*—Part I is a brief report of the third period of four years in an investigation to determine "The Influence of Crop Rotations and Farm Manures upon the Humus Content and Fertility of Soils." Since 1892 wheat, oats and barley have been grown continuously on four plots without the use of farm manure; on two other adjoining plots, rotations including clover, wheat, corn, oats and barley were followed and farm manure was applied. Originally these plots contained 7700 pounds of nitrogen per acre, to the depth of one foot. At the end of the twelve years the continuous wheat plot (unmanured) contained 5661 pounds; the plot (manured), having a rotation including clover once in five years, contained 6725 pounds; and the plot (manured), having a rotation in which clover occurred every fourth year, contained 7800 pounds. In other words, during the twelve years, a continuous crop, such as wheat, oats or barley, has removed about 2000 pounds of nitrogen per acre, to the depth of one foot from an original store of 7700 pounds. Continuous corn has removed 1400 pounds. The crops themselves took off but about 450 pounds of nitrogen, the remainder, about 1600 pounds, being lost through the decay of the humus and the liberation of gaseous nitrogen brought about by the system of continuous cropping. The five-year rotation removed but 975 pounds of nitrogen, while the four-year rotation increased the nitrogen content of the soil

100 pounds. From these figures, it is "Quite evident that when any crop, as wheat, corn, oats or barley, is grown continuously, the losses of nitrogen are large and that these losses can be either reduced to a minimum, or checked by growing the same crops in rotation with clover and using farm manures.

In Part II, "The Water-insoluble Plant Food of Soils," are given the results of an attempt made to grow wheat, oats and barley in extracted sand watered with leachings obtained by passing distilled water through a fertile soil. At the end of six weeks the wheat and barley plants died while the oat plants barely lived, but did not produce seed. Plants grown in the fertile soil developed normally. "It is quite evident that the soil leachings failed to supply a sufficient amount of plant food to produce normal plants of wheat, oats and barley. It is also evident that the plants grown in the pots of fertile soil obtained a large portion of their food from forms which are insoluble in water." "To the farmer these results are significant, as they mean that water alone coming in contact with a soil of high fertility is not the only factor necessary to render plant food available and to promote crop growth. Farm manures, judicious cultivation, rotation of crops, production of legumes, and, in some cases, amendments must be resorted to in order to bring about the initial changes in the soil, that convert the inert plant food into a condition to be utilized by crops, but not necessarily into water-soluble forms."

Part III is a continuation of reports given in former bulletins upon the production of humus by the decay of vegetable matter in farm manures and crop residues. In these investigations wheat gliadin, casein and egg albumin were used alone and also in connection with mineral substances such as calcium carbonate, potassium sulphate, ferrous acetate and iron succinate. Known amounts of the materials, both organic and inorganic, were mixed with subsoil and the boxes "exposed one year out of doors to allow humification to take place." During humification there was a combination of humus with considerable amounts of the phosphates and potash of the soil, and at the same time there was a loss of soil nitrogen. As to the form of the humic nitrogen remaining the author's state that "the results, taken as a whole, indicate that in an average fertile soil but little of the nitrogen which forms part of the humus is in amide condition, the larger portion being in forms allied to insoluble proteids and not readily acted upon by a dilute acid pepsin solution." A brief discussion of the value of humus as a plant food and as a factor in soil fertility is included in the report. J. H. PETTIT.

## PATENTS.

JANUARY 3, 1905.

778,846. Alphons Custodia, Dusseldorf, Germany. **Making coke.** Coal is mixed with the top dust of blast-furnaces containing iron, lime, silicic acid and alumina, grinding and briquetting the mixture, then coking to form a slag and sponge iron.

778,894. Charles J. Reed, Philadelphia, Pa. Assignor to Security Investment Co., same place. **Spongy lead.** Lead oxide and zinc dust are mixed and treated with a solution of zinc chloride till the lead is reduced, then washing out the zinc salts and inert material, all in the cold.

778,899. Arpad Bonay,. Budapest, Austria-Hungary. **Briquetting ore.** Granular or powdered ore is pressed in forms at 800 to 2,000 atmospheres to expel air and the blocks are treated with carbon dioxide without fritting.

778,901. Pedro G. Salom, Philadelphia, Pa. **Reducing lead ore.** Powdered lead sulphide is continuously spread on the surface of a cathode of antimonial lead in dilute sulphuric acid, the current passed, and the reduced mass of spongy lead is continuously removed at the exact rate of supply.

778,947. Charles L. A. Brasseur, New York, N. Y. **Transfer paper.** A pliable support to which a film of colored soluble gelatine is attached by an easily soluble interposed material as gum, albumen, wax or varnish.

778,980. Oscar Liebreich, Berlin, Germany. **Fatty acids.** Natural fats or oils are treated with aromatic bases to form acidulated derivatives and glycerol, which are separated, and the aromatic derivatives heated with sulphuric acid to form sulphates of the aromatic bases and fatty acids which are isolated.

779,037. James Gayley, New York, N. Y. **Smelting ore.** This ore is mixed with a limited amount of fuel and treated to a blast of dried air, allowance being made for the fuel ordinarily required to dissipate moisture.

779,058. Samuel W. Vaughan, Lorain, Ohio, and John W. Cabot, Johnstown, Pa. **Recovering metallic compounds** from solutions. An alkaline iron cyanide is first added and the precipitate removed, the residual alkaline salt recovered and the precipitated iron cyanides changed to hydroxides by caustic alkalies, simultaneously reconstructing and recovering the alkaline iron cyanides originally used, and finally precipitating the excess of precipitant by adding a soluble zinc salt and removing the zinc-iron cyanide thus obtained.

779,090. Albert L. Marsh, Lake Bluff, Ill. **Thermo-elec-**

**tric elements.** The couples are formed of alloys of copper and nickel, and chromium and nickel.

779,091. Walter Mills, London, England. Assignor to A. O. Granger, Carterville, Ga. **Lead silicofluoride.** A mixture of galena and cerussite is subjected to a blast of air while heated with hydrofluosilicic acid.

779,092. As above. Lead oxide is heated and stirred with an excess of hydrofluosilicic acid; when the acid is neutralized the product is filtered to get pure lead silicofluoride.

779,171. John A. Mathews, Syracuse, N. Y. Assignor to Crucible Steel Co., of America. **Tool steel.** Steel containing less than 1 per cent. carbon, more than 6 per cent. molybdenum, and from 0.1 to 1 per cent. vanadium.

779,175. Rudolph Muller, Höchst-on-Main, Germany. Assignor to Meister, Lucius und Brüning, same place. **Artificial silk.** Ammoniacal solutions of cellulose cuprammonium are forced through capillary tubes into alkaline solutions, the thread washed successively with acids and water, and dried.

779,187. Richard Schmidt, Holzminden, Germany. **$\alpha,\beta$-Methylionone.** Methylionone is heated with a soluble bisulphite, the oil is separated and purified. It boils at 135° to 140° C., at 20 mm. pressure, has a specific gravity of 0.931 and, an index of refraction of 1.5003 at 20° C., its semicarbazone melts at 202° C., and its bromphenylhydrazone at 124° to 125° C.

779,190. Elihu Thomson, Swampscott, Mass. Assignor to General Electric Co., N. Y. **Static electrical machine.** A machine having revolving plates sealed in oil in a casing so that no ozonized air exists around the moving parts.

779,195. Dick B. Williams, Connellsville, Pa. Assignor one-half to Joseph R. Stauffer, Scottdale, Pa. **Baking clay.** Molded clay is enveloped in amorphous coke and the whole fired, exposing the clay exclusively to the action of combustion gases.

779,196. As above, for treating a mixture of clay and abrasive material.

779,197-8. Horace W. Ash, Cambridge, Mass. Assignor to Warren Bros. Co., Boston, Mass. **Distilling bitumen.** The material is distilled and subjected to a hot blast of air and lampblack, forming an impalpable powder.

779,210. George Egly, Charlottenburg, Germany. Assignor to Gebrüder Siemens und Co., same place. **Barium oxide.** Barium carbonate, nitrate, and carbon are heated red hot.

779,228. Heinrich Mann, Munich, Germany. **Process of dyeing.** Consists in reacting on the fiber with a mixture of an amine from benzene, hydrogen peroxide and a colored metallic salt, as copper sulphate.

779,236. Rufus L. Odom, Nashville, Tenn. Assignor one-half to Hugh W. Pennell, Murfreesboro, Tenn. **Insecticide.** Paris green 5, carbolic acid and Fowlers solution of arsenic 50 each, and water 500 parts.

779,238. Hosea J. Romick, Hilliard, Ohio. **Rust preventer.** Asbestos fiber 1, Japan drier 8, raw linseed oil and red lead 32 each, Portland cement 100 parts.

779,252. Ralph Baggaley, Pittsburg, Pa. **Recovering metals.** Ferruginous copper-bearing smelter slag is powdered and brought in contact with copper-bearing water, whereby the slag acts as a precipitant.

779,261. Henriette Breyer, Kogel, near Neu Lengbach, Austria-Hungary. Assignor four-fifths to Alfred Jurnitschek von Wehrstadt, Castle Puchberg, near Wels. **Purifying sugar juice.** A mixture of calcium hydroxide and brick dust 2 to 1, is added to the juice at 80° C., in quantity more than 1 per cent. of the beet root, and carbon dioxide is blown through.

779,277. Raoul A. Grimoin-Sanson, Paris, France. **Treating cork.** It is soaked in thin sheets in a mixture of benzene or turpentine 80, glycerol 3, Para rubber 0.5, and hydrochloric acid 5 parts, and it is then cemented to a fabric by a cement of caoutchouc 20, gasoline 200, and acetone 1 part.

779,290. Iens P. Lihme, Cleveland, Ohio. Assignor to Grasselli Chemical Co., same place. **Sodium acetate.** Solutions of calcium acetate and sodium sulphate are mixed with barium carbonate, the solution concentrated, oxidized by air and the sodium acetate crystallized out.

779,307. Thomas B. Parkison, Muncie, Ind. **Mineral wool.** Molten slag is projected through a body of smoke by steam.

779,310. Samuel Peacock, Chicago, Ill. **Obtaining metals.** Sulphides of iron and zinc are pulverized and roasted, reduced at a temperature intermediate between the reducing temperatures of iron and zinc, the whole cooled in a reducing atmosphere, and the iron separated and afterwards the zinc reduced.

779,377. Bruno R. Seifert, Radebeul, near Dresden, and Curt Philipp, Dresden. Assignors to Chemische Fabrik von Heyden, Radebeul, Germany. **Bornyl esters.** Terpenes are heated with aromatic oxycarbonic acids, the esters thus obtained split by heating with caustic alkalies, and the resulting borneols oxidized to camphor. The new bornyl esters of the aromatic oxycarbonic acids have the formula $C_{10}H_{17}OCO—R—OH$, in which R is an aromatic nucleus, forming oily substances, insoluble in water, scarcely soluble in alcohol, more easily in ether, benzene and chloroform, decomposing on distillation, and splitting by hot caustic alkalies into borneol and an aromatic oxycarbonic acid.

779,383. Clinton P. Townsend, Washington, D. C. **Electro-**

**lytic apparatus.** A vessel of two compartments has a pervious cathode between them, an anode and electrolyte in one compartment and a body of non-saponifying oil in the other.

779,384. As above, for the **electrolytic process,** of the above apparatus applied to salts of alkali metals.

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779,421-2. Fletcher B. Holmes, Woodbury, N. J. Assignor to Eastern Dynamite Co., Wilmington, Del. **Nitrated starch.** The starch is nitrated, separated from the acids and boiled in the presence of calcium carbonate. The second is for dissolving the nitrated starch in a mixture of alcohol and acetone, distilling off the acetone and separating the starch from the alcohol.

779,516. John Armstrong, Chicago, Ill. **Cutting self-hardening steel.** The edge of a rapidly rotating disk of tool steel is held against a mass of self-hardening steel for some time, and then forced into the material.

779,527. Herbert H. Church, Bellows Falls, Vt. **Wax emulsion.** Fifty parts each of paraffine wax and stearic acid are heated in water, and an alkaline solution of 20 parts of borax added, the whole stirred till it ceases to froth.

779,553. Achille Meygret, Paris, France. **Covering for storage battery plates.** The plate carrying the active material is dipped in sugar syrup and then into cellulose tetracetate, the first coat being soluble and the second protective.

779,583. Hezekiah K. Brooks, Bellows Falls, Vt. **Adhesives.** Starch is heated with ammonium persulphate, sulphuric acid and water, and borax added.

779,604. John E. Jones and Michael Meehan, Boston, Mass. **Road surface compound.** Asphalt and Portland cement 10 parts each, heated to 350° F., and mixed with 80 parts of sand.

779,634. Samuel W. Allen, Peck, Idaho. **Vermin poison.** Carbon bisulphide carbolic acid solution 10, and cayenne pepper.

779,637. Carl C. L. G. Budde, Copenhagen, Denmark. **Sterilizing.** Food containing an enzyme is heated with hydrogen peroxide to 40° C., and then an enzyme as pressed yeast added to decompose the remaining peroxide.

779,674. Henry Staier, Brooklyn, N. Y. **Match composition.** Oxide of zinc and plaster of Paris 8 parts each, whiting 4, powdered sulphur 6, red phosphorus 20, potassium chlorate 90, powdered glass 42, and glue 32 parts.

779,696. Ferdinand Ephraim, San Francisco, Cal. Assignor one-half to Albert Raas, same place. **Obtaining gum from rubber plants.** The material is disintegrated in a closed, rapidly revolving vessel, heated to make the milk exude, washed with

water to separate the gum, which is removed from the surface of the water.

779,705. Wm. T. Gibbs, Buckingham, Canada. Assignor to the National Electrolyte Co., N. Y. Electrolyzing alkaline solutions of **sodium chromate.** A weak solution of sodium chromate containing sodium carbonate is concentrated till the free alkali is removed as sodium bicarbonate insoluble in the solution; the neutral solution is then electrolyzed to make an anode solution of sodium bichromate and a cathode solution of caustic soda, to which, after removing the free alkali, fresh neutral sodium chromate is added and the process repeated.

779,728. John M. Morehead, Chicago, Ill. **Making lampblack** from acetylene. A compressed mixture of acetylene and air is exploded and the liberated carbon removed by an air-blast.

779,752. Robert Warnock, Westboro, Mo. **Paint.** Carbolic acid and asafoetida two ounces each, pine tar two gallons and fish oil one gallon.

779,760. Christian E. Bichel, Hamburg, Germany. **Explosive.** One part of glue is dissolved in 7 parts of glycerol and 5 parts of nitroglycerine. Other proportions are given.

779,761. Guido Blenio, New York, N. Y. **Fire-proofing wood.** The wood is steamed, dried and soaked in a mixture of ammonium phosphate, starch and water.

779,777. Johannes Gaedicke, Berlin, Germany. **Silver emulsions.** A non-matured emulsion is washed, treated with ammonia, and neutralized with sulphuric acid.

779,797. Wilhelm Ostwald and Oscar Gros, Leipsic, Germany. **Reproducing pictures** by catalysis. A platinum print is brought into contact with hydrogen peroxide dissolved in ether, reacting on the portions not catalytically affected with a ferrous salt, as ferrous ammonium sulphate 20 per cent., subjecting gelatine to the action of the reaction product and coloring the gelatine.

778,816. Carl Steffen, Vienna, Austria-Hungary. **Treating sugar beets.** One part of disintegrated beet root is mixed with four parts sugar juice at 60° to 100° C. to open the cells that the juice may exude freely.

779,825. Heinrich Weltz, Ludwigshafen-on-Rhine. Assignor to Badische Anilin und Soda Fabrik, same place. **Anthraquinone dye.** A purpurinsulphonic acid and an amidosulphonic acid, as metanilic acid, are condensed together forming a dye soluble red in hot aniline or hot water, the solution becoming violet on adding ammonia or sodium carbonate, and the solution in concentrated sulphuric acid turning bluish with boric acid, dyeing unmordanted wool blue-red, and chrome mordanted wool red-blue.

779,833. Maylean Bjornstad and Joseph Stacey, Auckland, New Zealand. **Medicated sweetmeat.** Cream of tartar 0.13, beech-wood creosote 13, malt and butter 60 each, sugar 500 parts.

779,853. Samuel Hughes, Summerville, S. C. Assignor one-half to Edward F. Lowndes, Charleston, S. C. **Acid pump.** Concentric pipes are placed in a well, the outer one closed at the bottom and the inner one open at bottom and top, the latter in the receiving tank, and air pressure supplied to drive the liquid up the inner pipe.

779,860. Arthur Luttringhaus, Ludwigshafen-on-Rhine. Assignor to Badische Anilin und Soda Fabrik, same place. **Violet sulphur dye.** From dichlorindophenol, yielding blue solutions in sulphuric acid, dyeing unmordanted cotton green-gray to blue-gray, turning violet in the air.

779,887. George H. Stewart, Los Angeles, Cal. **Solder plate.** A sheet metal plate is coated with lead one side and tin the other, so that when brought together they form a solder.

779,941. Samuel Hughes, Summerville, S. C. **Acid pump.** Similar to 779,853, but adapted to connect several tanks.

779,998. Wm. T. Gibbs, Buckingham, Canada. Assignor to Electric Reduction Co., same place. **Hydrochloric acid.** Hydrogen in excess is brought into contact with chlorine at a temperature above the combining-point, and condensing the acid.

780,001. Wm. A. Hall, Bellows Falls, Vt. Assignor to Casein Co. of America, New Jersey. **Paint.** Sodium silicate 90, asbestos 10, thoroughly mixed, and 200 parts of whiting, with 15 parts of resin oil and 100 parts of water.

JANUARY 17, 1905.

780,094. Wm. Forger, New York, N. Y. **Detergent.** Benzine 20 gallons, calcium chloride 3 pounds.

780,128. Frank A. Reynolds, Lewiston, Me. Assignor to Stephen H. Manning, Herschell C. Parker and self, New York, N. Y. **Brazing compound.** Spelter copper, aluminum, and iron oxide in equal parts are melted together.

780,185–6. Vincent B. Russell, New York, N. Y. **Billiard cloth.** The first one side silk and the other cotton, and the second one side mercerized cotton and the other side unmercerized.

780,191. Woolsey M. Johnson, Hartford, Conn. **Electrolysis of metals.** A series of electrolytic tanks are arranged step-wise, the first and last being connected by a pipe. An electrode of impure iron is immersed in a solution of ferrous ammonium chloride with excess of acetic acid, the iron is deposited on a pure iron electrode, the precious metals going into sludge, and the electrolyte being subjected from time to time to a process of

cementation with iron in another receptacle to remove the copper and maintain the iron in a ferrous condition.

780,206. Wm. J. Little, Newton, Mass. **Plate for graphic negatives.** A plate with a translucent base and a translucent etching surface or ground coating said base, non-actinic, and with lines of incision cut through corresponding with a subject, and filled with colors having different actinic properties. An etching is made from the subject sighted through the plate.

780,226. Leonard Pink, Berlin, Germany. Assignor to Milton O. Alexander, San Francisco, Cal. **Castor oil praline.** Ricinoleic acid is removed from castor oil by heating the latter with magnesium carbonate and ammonium urate, filtering through a dry filter in a steam-bath, and absorbing the filtered oil by powdered magnesia, and cocoa in powder.

780,240. Thomas J. Spitzer, Morristown, Tenn. **Plastic compound.** Plaster of Paris 50, powdered sulphur 4, alum in powder and dried sawdust 2 each, borax in powder $^1/_4$ part, mixed with sufficient water.

780,241. Karl Stephan and Paul Hunsalz, Berlin, Germany. Assignors to Chemische Fabrik auf Aktien, Berlin, Germany. **Dialkylbarbituric acid.** Diethylmalonylguanidine is oxidized in acid solution, and the barbituric acid separated.

780,281. James H. Gillies, Melbourne, Victoria, Australia. **Recovering zinc.** A conical vessel with steam-jacket is provided with a series of V-shaped, overlapping, inclined catchment chutes, a central escape for the sulphides, an escape for the dross and a cold water supply to the bottom of the receptacle.

780,293. Thomas B. Joseph, San Francisco, Cal. **Leaching metals.** A solution is used containing sodium cyanide, ammonium bicarbonate and calcium hydroxide, and the ore is agitated with compressed air.

780,297. Stephen R. Krom, Plainfield, and Stanley V. Krom, Jersey City, N. J. **Separating graphite from wollastonite.** The material is put in a bath of dilute sulphuric acid which loosens the bond between the lime and silica in wollastonite, the lime is washed away, and the graphite and silica are washed and separated.

780,328. Thomas R. Demery and George W. Schooley, Harrisburg, Pa. **Plate printer's cleaner.** Ammonia 500, camphorated oil and oil of sassafras 3 each, starch 15, and potassium carbonate 1 part.

780,340. Maurice Herrisson, Paris, France. **Oil paint.** Barium silicate 20, hydrated silica and pure kaolin 5 each, alumina 10, infusorial earth 18, zinc oxide 20, and linseed oil 22 parts.

780,352. Emil Kafka, New York, N. Y. Assignor to Fire-

less Heating Co., same place. **Heat compound.** Lead acetate and sodium acetate 25 each, and sodium sulphate 50 parts. Adapted to retain and gradually emit heat.

780,379. Herbert Paschke, New York. **Water-proofing.** Sheets of burlap are coated with petroleum residuum to line tunnel walls. The residuum is called cerion, and may be dissolved in naphtha.

780,404. Max Bazlen and Hans Labhardt, Ludwigshafen-on-Rhine, Germany. Assignors to Badische Anilin und Soda Fabrik, same place. **Oxidizing the methyl group.** An acid solution of manganese persulphate is used to oxidize the side-chains in aromatic derivatives as *o*-nitrotoluene.

780,448. Victor Schutze, Riga, Russia. **Crystallizing apparatus and process.** A hot concentrated solution is made to pass slowly through a tube surrounded by a cold water jacket whose temperature lowers from the water delivery to the water supply (Liebig condenser).

780,464. Utley Wedge, Ardmore, Pa. **Briquetting iron pyrites.** Pyrites fines are moistened and used as a cement to stick the coarser particles together in a block under pressure.

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780,603. Abraham De Solla, San Francisco, Cal. **Fibrous shapes.** The husks and pollen of cocoa shells are ground, mixed with sodium silicate, dried and molded.

780,619. Robert Pschorr, Berlin, Germany. **Morphine compound.** An alcoholic solution of morphine and caustic alkali 1 molecule each is heated with 2 molecules of ethyl bromide to 50° to 60° C., for several hours in a closed receptacle, cooled, extracted with alcohol, the alcohol distilled off and the residue purified by crystallization from hot water. Codeine brommethylate of formula $C_{18}H_{21}NO_3BrCH_3$, is a bitter neutral body melting at 261° C., soluble in water and warm methyl alcohol, less so in acetone, insoluble in ether and benzene, crystallizing with picric acid, yellow, with mercuric chloride, yellow-white, with phosphomolybdic acid, flesh color, decomposed by strong sulphuric acid with liberation of hydrogen bromide.

780,651. Jean M. A. Gerard, Paris, France. **Obtaining metals.** Enough carbon is mixed with iron ore to reduce the latter to a sponge, which is melted by an electric current, collected in a refining furnace, the hot gases from the shaft reduction furnace being passed through the refining furnace and then through the ore charge, and finally the metal is boiled in an oxidizing gas by an electric current of high voltage and low amperage.

780,741. Rudolf Berendes, Elberfeld, Germany. Assignor to Farbenfabriken Elberfeld Co., New York, N. Y. **Sensitizing dye.** Quinoline is made to react on the ethyl ester of *p*-toluene

sulphonic acid, and the product is treated with ammonia and heated with caustic alkalies, forming green-bronze needles soluble in alcohol blue-violet, and sensitizing photographic emulsions for distinct colors of the spectrum, and dyeing silk in an ammoniacal bath, red.

780,886. Rudolf Hutzler, Ludwigshafen-on-Rhine, Germany. Assignor to Badische Anilin und Soda Fabrik, same place. **Purifying indigo.** The indigo is heated with an etherified phenol in such quantity as to dissolve the impurities, while not dissolving the indigo.

780,924. Jacob Weidmann, Paterson, N. J. **Dyeing silk.** The silk is tin weighted, then treated with an acidulated bath, a black iron bath, a black iron gambier bath containing coloring-matter, and then to a dyeing bath.

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780,975. Gustave V. Casteele, fils, Ghent, Belgium. **Molded horse hair.** Bits of horse hair are put in a mold, steamed, cement added and pressed to a solid form. If the cement is omitted an elastic bat is made, adapted for cushions, etc.

780,976. Gino Ciapetti, Strada, Italy. **Cream of tartar.** Marc is steamed in closed vessels to obtain the alcohol, sulphurous acid passed through and the solution decomposed by heat into sulphurous anhydride, potassium hydroxide and tartaric acid, the first being removed by steam while the last two combine to potassium bitartrate, which crystallizes from the cooled solution and is then purified by recrystallization.

780,984. Hans Foersterling, Perth Amboy, N. J. Assignor to Roessler and Hasslacher Chemical Co., New York, N. Y. **Tin oxide.** A continuous process of acting on tin with air heated above the temperature at which the lower discoloring oxides are formed, in a suitable furnace heated to the oxide-forming temperature, and removing the oxide.

781,025. George H. Rupley, Schenectady, N. Y. Assignor to General Electric Co., New York, N. Y. **Insulating coils.** The coil is spread so that adjacent turns do not touch, then dipped in prepared linseed oil turned and dipped again, then baked, and the operation repeated if desirable.

781,079. Friedrich W. A. Loebell, Muegeln-near-Dresden, Germany. **Dust prevention.** The road is sprinkled with waste wood pulp lye containing resins and salts adapted to bind the surface of the road-bed to a mass.

781,133. Chauncey E. Dewey, Denver, Col. Assignor to American Zinc and Chemical Co., same place. **Treating zinc iron sulphides.** The ore is roasted and agitated with sulphurous gas under pressure while suspended in water, producing zinc sulphate and ferric oxide.

781,178. Harry Bashinski, Jr., Tennille, Ga. **Paint remover.** Carbolic acid and oil of citronella, 2 parts to 1.

781,230. Hugh Rodman, Cleveland, Ohio. **Coating metals.** The metal is coated first with an alkali metal then with the metal desired, or they are mixed, the alkali metal serving to clean the metal coated.

781,240. Eric A. Starke, Alameda, Cal. **Making asphaltic oils more limpid.** The oil is partially distilled at 500° to 650° F., and the remainder of the oil and the distillate mixed.

781,242. John C. H. Stut, Oakland, Cal. **Making gas.** Two contiguous connected ovens have oil sprayed first into one, then the other, the temperature being kept at a point adapted to gasify the lighter constituents in one oven and fix them in the other alternately, the residue being coked.

781,249. Otto J. Weil, Chicago, Ill. Assignor to American Featherbone Co., same place. **Featherbone stiffener.** Feather fibers are bundled in strips, sized, dried, heated above 175° F., and rolled under pressure.

781,255. Frank A. Widdows, Stockton, Cal. **Fire-brick.** Ground fire-clay is mixed with water, powdered charcoal and chromium added and the mixture dried.

781,288. Albert L. Marsh, Lake Bluff, Ill. Assignor to Wm. A. Spinks and Co., Chicago, Ill. **Thermo-electric element.** One element is an alloy of chromium and nickel, and the other nickel or nickel and copper.

781,289. As above for molybdenum and nickel.

781,290. As above for tungsten and nickel.

781,300. Thomas Prescott, Huddersfield, England. **Alloys.** Iron 1, aluminum 35, zinc 50, the same being melted and mixed and then covered with a powder of potassium silicofluoride, calcium chloride, glass, carbonates of soda and lime, and common salt. The above proportions may be varied.

781,338. Albrecht Heil, Frankfort-on-Main, Germany. Assignor to the firm A. Wolf, Jr., same place. **Soldering thermo-electric couples.** The more infusible constituent is heated above the melting-point of the more fusible element, and the latter rubbed on the first till it is coated, pressing the two bars in contact without allowing any oxide between them, raising the temperature and squeezing them together.

781,341. George E. Hipp, Buffalo, N. Y. **Aluminum and sodium sulphate.** Niter cake and an alkaline sulphide are dissolved and the solution clarified, an aluminous product is added and the mixture again clarified, then aluminum sulphate added to produce the double sulphate and also one half per cent. free acid, and the whole calcined.

781,363. Marie Ritter, Breslau, Germany. **Medicaments containing plant juices.** Phosphorescent material, as sulphides of the alkaline earths or plant ashes, is mixed with plant juices containing living cells, water is added and the whole exposed to radiation.

781,380. John C. H. Stut, Oakland, Cal. **Making gas.** A series of contiguous connected ovens are charged with coal, air admitted over and beneath the coal, adding green coal to some of the ovens, shutting off the air and dropping oil on the hot coals of the other ovens to which steam is also supplied, and all three, coal-, oil- and water-gas are mixed.

781,454. Truman G. Palmer, Chicago, Ill., and Harry B. Cox, Washington, D. C. Assignor to Palmer. **Bunsen burner.** There are two diaphragms in the burner tube, the one highest up having a larger aperture for gas, the lower diaphragm forming a mixing chamber beneath it.

781,472. Joseph Tscherniac, Freiberg, Germany. **Cyanides.** A mixture of hydrogen cyanide and an alkali hydroxide are heated to 200° C. first, and then to 300° C., the water being thus driven off.

781,502. Charles L. Dowell, So. Bend, Ind. Assignor to Globe Coal Manufacturing Co., same place. **Artificial fuel.** Lime 25, salt and rosin 20 each, saltpeter 12, sodium sulphate 6, and sodium bicarbonate 6 parts by weight.

781,506. Max Erfurt, Straupitz-near-Hirschberg, Germany. **Emulsifying rosin soap** in water. The soap is heated, mixed with water under steam pressure and sprayed into lime-water.

781,520-1. Hascal A., and Herbert A. Hogel, New York, N. Y. Assignors to Hascal A. Hogel and David Wallace, same place. **Treating ores.** The ground ore or slime is agitated by stirrers and steam jets in a chemical solution, as a cyanide.

The last is for **apparatus** consisting chiefly of tanks with stirrers arranged step-wise to carry out the above process.

781,605-6. Cooper Hewitt, New York, N. Y. **Method of obtaining oscillatory currents and light.** Assigned to Cooper Hewitt Electric Co. A current of sufficient potential to overcome the resistance of a mercury lamp, for example, is passed interruptedly through, the interruptions being caused by a drop in potential.

781,612. Mark W. Marsden Philadelphia, Pa. **Utilizing cotton plant.** The whole plant is comminuted in water, subjected to steam-pressure at 75 to 90 pounds to dissolve pectin and convert carbohydrates to sugars, drawing off the liquor and repeating the process till a high-grade paper stock is left.

WILLIAM H. SEAMAN.

# REVIEW OF AMERICAN CHEMICAL RESEARCH.

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WILLIAM A. NOYES, Editor.

REVIEWERS:

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## GENERAL AND PHYSICAL CHEMISTRY.

**Investigations Concerning "Heat Shrinkage."** BY RICHARD LUCAS. *Z. phys. Chem.*, 52, 327–342.—If the infusible oxides are heated up to a very high temperature they undergo a very considerable permanent contraction, "heat shrinkage," which property is of great importance in ceramics. It is this "heat shrinkage" which gives to the substances thus treated the strength which makes them useful. If the substance was in the form of a fine powder, it was formed into a stiff dough by addition of water and a little binding material, formed into a cylinder by passing through an opening and then dried. These cylinders were measured with a micrometer, and the heating was carried out in several different forms of electrical furnaces. The temperatures were obtained by a thermoelectric junction and by comparing the light intensity of the furnace with a calibrated Nernst filament. Cobalt oxide, magnesia, kaolin, and zirconium oxide were investigated. The "heat shrinkage" was, of course, determined by comparing the dimensions of the cylinders before and after heating. For a given temperature, the shrinkage was found to be greater for rapid than for slow heating, although this difference disappears altogether at very high temperatures. The shrinkage increases rapidly with increasing temperature and approaches a limiting value asymptotically, and is dependent upon the previous history and nature of the substance used. The linear shrinkage is greater in a vertical than in a horizontal direction, and this is the more pronounced the higher the temperature. The author considers this as evidence for the amorphous state of the substances. The strength of the material increases rapidly with the temperature and approaches a limiting value. The relation between the shrinkage and the time may be expressed by a logarithmic equation. The shrinkage and porosity of the substance are closely related, and the author shows that the shrinkage is due to the decrease in

the porous volume, while the actual density of the substance remains the same or even decreases. This change in the substance he thinks probably due to capillary forces, the porous material being a viscous amorphous substance. Shrinkage does not occur to any considerable extent until a temperature of 600° or 700° has been reached. C. A. KRAUS.

**Measurement of Various Thermal and Electrical Effects, Especially the Thomson Effect in Soft Iron.** BY EDWIN H. HALL AND MESSRS. CHURCHILL, CAMPBELL, AND SERVISS. *Proc. Am. Acad.*, **41**, 23–55.—If two ends of a metal bar be kept at constant temperatures and a current be sent through the bar, the amount of heat developed by the current will depend on the direction of the current relative to the direction of flow of heat, being greater when it flows from cold to hot than when it flows from hot to cold, if the bar be of iron. This heat effect is the Thomson effect, and its measure is the mean amount of heat $\sigma$ produced per second, in excess of the normal Joule effect, when one absolute C. G. S. unit of current flows downward through a temperature interval of 1°. The authors apply a more refined apparatus than has hitherto been employed to determine this constant for very soft iron. The method requires the determination of the thermal and electrical constants of the iron along with the temperature gradient and temperature differences at different points of the bar, thermoelectric junctions being employed in the temperature measurements. The value of $\sigma$ is determined to $\sigma = -0.0000246$. Assuming that $\sigma$ varies proportionally to the absolute temperature, they determine the mean coefficient of the Thomson effect to $\nu = -767 \times 10^{-10}$ between the temperatures 13° and 90.3°. Battelli had previously concluded that $\sigma$ does not vary proportionally to the absolute temperature in iron, *i. e.*, $\nu$ is not a constant. The authors calculate the value $\nu = -715 \times 10^{-10}$ and $-793 \times 10^{-10}$ for the temperature intervals 13°–51.1° and 51.1°–90.3°, respectively. C. A. KRAUS.

**On the Distribution of Velocity among the Members of a Group of Gas Molecules.** BY G. H. MEEKER. *J. Frank. Inst.*, **159**, 383–395.—The author attempts to show that, contrary to the accepted theory of the distribution of velocities, the velocities of the different molecules of a gas are sensibly equal. Six arguments are put forward in support of this hypothesis, for the details of which the reader must consult the original. C. A. KRAUS.

**Viscosity of Air.** BY J. L. HOGG. *Proc. Am. Acad.*, **40**, 611–626.—Attention is called to the discrepancies in the values found for the viscosity of air, even when the methods used in determining this quantity involve the same principles. A new determination of this quantity was therefore undertaken. The method employed consists in determining the damping effect of

the air on an oscillating system, *i. e.*, in determining the logarithmic decrement, due to the resistance of the air. Two oscillating systems were employed, one consisting of a disk and a sphere, oscillating about an axis through the center of disk and sphere and at right angles to the disk, the other of a disk alone with the oscillating axis at right angles to the disk through its center, the same quartz fiber serving as support for both systems successively. The materials of the two systems were so chosen that the moment of inertia and the mass of the first system were equal to those of the second, and the dimensions of the disk of the first system were equal to those of the disk of the second. The difference in the logarithmic decrements of the two systems gives the decrement due to the sphere of the first system alone. It is pointed out that in the expression for the motion of a sphere in a viscous fluid, as derived by Stokes, terms of the second degree are neglected and that this is not always permissible. If this simplification is not permissible, then the logarithmic decrement depends on the velocity and must change as the amplitude of vibration changes. By observing that the decrement is independent of the amplitude it was shown that, for the systems employed, the logarithmic decrement is a constant. The value of the coefficient of viscosity of air was determined in the neighborhood of 15° and 23°. These were reduced to 0° by the formula of Holman, giving the mean value for the coefficient of viscosity of air under normal conditions at $\mu_0 = 0.0001713$, the extreme values being 0.0001708 and 0.0001716. This value is very near the mean of those obtained by the more recent investigators. The results of Reynolds, however, give $\mu_0 = 0.0001768$, for which high value some explanations are offered. The investigation is to be continued. C. A. KRAUS.

**Thermal Expansion of Hydrogen and Carbon Dioxide under Constant Pressure.** BY THEODORE WILLIAM RICHARDS AND KENNETH LAMARTINE MARK. *Proc. Am. Acad.*, **41**, 117–140.—The authors have improved the apparatus previously described (this Journal, **25**, R 226) and have carried out a new series of determinations on the expansion of hydrogen and carbon dioxide. The improvements consist chiefly in improving the methods of determining the constants of temperature, pressure, and volume and in eliminating errors due to temperature changes, by keeping the room at constant temperature. For hydrogen the coefficient of expansion was found to be 0.0036609, the pressure being 762.6 and 762.4 mm. of mercury, and the temperature change being from 0° to 32.38°. The results are considered reliable to one in the fifth significant figure although the probable error, according to the method of least squares, is much less. From the work of Rayleigh, Travers and others the authors calculate the value of the coefficient at the pressure of the experiments above, obtaining

the value 0.00366065 in excellent agreement with the results found. For carbon dioxide, at a pressure of 761.5 mm. of mercury, the coefficient of expansion, at constant pressure, is determined to be 0.0037282. C. A. KRAUS.

**New Methods of Determining the Specific Heat and the Reaction Heat of Liquids.** BY THEODORE WILLIAM RICHARDS AND ARTHUR BECKET LAMB. *Proc. Am. Acad.*, 40, 659–680 — The authors describe the apparatus to be used in determining the specific heat and the reaction heat of liquids, and communicate some preliminary results which show the degree of accuracy that may be attained therewith. The method used is a method of mixture with a substance of known specific heat, *i. e.*, water. The chief ends aimed at in the construction of the apparatus are: to provide for the reading of all thermometers in temperature equilibrium, *i. e.*, with stationary thread, to secure complete mixture in the smallest possible time, and to reduce all gains and losses of heat to a minimum, the two to cancel each other as nearly as possible. The apparatus consists essentially of two pipettes maintained at two different temperatures within 0.001° by means of two thermostats. The liquids from the two pipettes are mixed by allowing them to flow together into a platinum calorimeter and subsequent stirring. The calorimeter consists of a platinum vessel surrounded first by a thin air space and then by a water jacket whose temperature is adjusted equal to that of the resulting mixture. The accuracy of the method is limited only by the accuracy of the thermometric measurements and, since these are made with stationary thread, the advantages of the method are apparent. For many important details such as the regulation of the thermostats, the arrangement of the apparatus, and the application of corrections, etc., the reader must be referred to the original.

Since, in the above method, the heat of dilution enters when one of the liquids in question is a solution, it becomes necessary to determine this quantity. This was done by means of a beaker, divided into two compartments by a detachable diaphragm of silver foil. The two compartments, each provided with a thermometer and a stirrer, were filled with water and solution respectively, and placed in a calorimeter at the desired temperature. When the two sides were in equilibrium and the thermometers were slowly rising, the diaphragm was removed, the contents were mixed by stirring, and at the end of a couple of minutes, when the thermometers recorded the same rate of cooling, the average change of the two thermometers along with the radiation correction gave the necessary data for calculating the heat of dilution. Some preliminary results are given to show the applicability of the method.

Knowing the heats of dilution of a solution at two tempera-

tures, and the heat capacity of the concentrated solution and of pure water, the heat capacity of a more dilute solution may at once be found by applying the method suggested by Berthelot. The authors apply this method and show that it yields satisfactory results. C. A. KRAUS.

**The Elimination of Thermometric Lag and Accidental Loss of Heat in Calorimetry.** BY THEODORE WILLIAM RICHARDS, LAWRENCE J. HENDERSON AND GEORGE S. FORBES. *Proc. Am. Acad.*, 41, 1–19.—The sources of error in calorimetric measurements are first discussed, and they are found to be actual loss of heat and failure of the thermometer to follow, with sufficient speed, the actually changing temperature of the calorimeter. A simple graphical method is given for determining the thermometric lag for a given thermometer in a given bath at any given rate of cooling. In a certain instance the lag was found to be 0.004°, the liquid being stirred and cooling at the rate of 0.02° per minute. The application of Newton's law of cooling to systems suffering sudden temperature changes is also considered uncertain. It was proposed therefore to devise a new method of measurement in which these two errors are eliminated, the fundamental principle of this method being to surround the calorimeter by a jacket whose temperature can be controlled and at all times kept equal to that in the calorimeter. Some preliminary measurements were carried out with mercury. The measurements were first carried out in the usual way, applying the Regnault-Pfaundler method for correcting error from radiation. For four determinations the average value of the specific heat in arbitrary units was found to be 611 ± 1. A similar determination was next carried out with the same apparatus in which the temperature of the surrounding jacket was increased at the same rate as that of the calorimeter, by pouring sulphuric acid into the caustic soda solution in the jacket. The average value in terms of the previous units was found to be 606 ± 0.06. It was further shown that in part, at least, the discrepancies resulting from the usual calorimetric method are due to thermometric lag.

Similar measurements, but with more refined apparatus, were carried out in which the heat change to be measured was brought about by the reaction of sodium hydroxide with sulphuric acid. Making corrections for thermometric lag and for radiation, the average temperature change for five determinations was found to be 2.863 ± 0.002° by the usual method, the average correction for thermometric lag being 0.0064°. Using the new method, in which these corrections are eliminated the average temperature change was found to be 2.860 ± 0.001°. The probable error by the new method is thus only one-half as large as by the usual method, and the two methods give the same value within the sum of the probable errors, when the results of the usual method are

corrected for thermometric lag. It seems that nearly all calorimetric results which have been published are uncertain to the extent of the error involved in the correction for thermometric lag, unless the rate of cooling or warming was very small.

C. A. KRAUS.

**A New Allotrope of Carbon and Its Heat of Combustion.** BY W. G. MIXTER. *Am. J. Sci.*, 19, 434–444.—Discrepancies between the values found for the heat of formation of acetylene by Thomsen and Berthelot and the heat of dissociation as found by the author have led the author to examine the thermal values of the constituents. The acetylene carbon is a grayish black, lusterless and very bulky porous mass. Compressed, it has a brilliant black luster but not the metallic appearance of graphite. In its chemical properties it behaves differently from charcoal or graphite. Its density is approximately 1.919 at room temperature. The mean value of its heat of combustion as determined from several series of experiments was found to be 94728 calories, while that for sugar charcoal and graphite determined with the same apparatus yielded the values 96700 calories and 94000 calories, respectively. The heats of combustion of sugar charcoal, graphite and diamond are 96500, 93559 and 93240 calories, respectively, according to Favre and Silbermann, while those of wood charcoal, graphite and diamond as determined by Berthelot are 97650, 94810 and 94310 calories, respectively. C. A. KRAUS.

**Reaction Velocities in Heterogeneous Systems with Particular Reference to Enzyme Action.** BY GEORGE SENTER. *J. Phys. Chem.*, 9, 311–319.—The author discusses Nernst's theory according to which the reaction velocity in a heterogeneous system is conditioned by the rate of diffusion of the reacting substances and reaction products to and from the bounding surface, rather than by the rate at which reaction takes place within the bounding surface itself. It is pointed out that it is possible that the observed velocity may be the resultant of the two constituent velocities. The criteria are then discussed which might serve to distinguish whether the reaction rate is conditioned mainly by the rate of diffusion or by the rate of chemical action. As criteria the author considers: relation between diffusive power and reaction velocity; effect of substances which alter the viscosity of the solution on the reaction velocity; the temperature coefficient of the reaction. The first criterion is considered of doubtful applicability, particularly in the case of colloids. The second criterion is also doubtful because of the possible diminution of activity of the substance to which diffusion is taking place. According to the third criterion the change in velocity due to change in temperature should be about 25 per cent. for every 10°, since the diffusion coefficient increases very nearly 2.5 per cent. per degree. If the rate of reaction increases more than 25 per cent. per 10°, this

would indicate that in part, at least, the reaction velocity is due to the rate of chemical change. In a table are given the quotients of the velocity constants of some enzyme actions for a temperature change of 10°. The quotients vary all the way from 1.3 to 5.3, from which the author concludes that the diffusion theory cannot explain the velocity of enzyme actions, and that the velocities measured in the cases most accurately investigated are chemical reaction velocities. C. A. KRAUS.

**The Preparation and Properties of Colloidal Mixtures.** BY ARTHUR A. NOYES. *Pop. Sci. Monthly*, 47, 268–279.—The present article is based upon the presidential address of the author at the Philadelphia meeting of the American Chemical Society, December, 1904 and since it has been published in full in the Journal of the Society (Vol. 27, 85–103,) further details are unnecessary.

C. A. KRAUS.

**Hydration in Solution.** BY GILBERT N. LEWIS. *Z. phys. Chem.*, 52, 224–230.—Certain salts, *e. g.*, copper and cobalt salts, exhibit different colors depending on the concentration of their solution. These were first observed by Wiedemann and ascribed to hydration. Later, however, these color changes were ascribed to the formation of colored ions which theory derived its main support from the fact that the addition of a salt with a common ion produces the same color change as a concentration of the solution. The author mentions some unpublished results of Professor H. M. Goodwin, according to which the change of color and of dissociation do not run parallel, but the color change takes place at much greater concentration, while in more dilute solutions change in dissociation is not accompanied by any color change. The author points out that hydration is a reversible reaction and the observed change in color may be due either to change of dissociation or to change in the active mass of the water. The author prepared 3 N solutions of various acids and salts, to equal volumes of which he added the same quantity of copper bromide. Except in the case of the bromides, the color of the resulting solutions were blue to green, but in the case of the bromides the color was olive-brown. Other salts of copper and cobalt exhibited a similar behavior. To determine if the color change is due entirely to a common ion effect, the author adds the same quantity of copper bromide to 3 N solutions of KBr, $NH_4Br$, NaBr, and LiBr. In these the concentration of the bromine ion is greatest in the KBr-solution and smallest in the LiBr-solution, while those of the other two are intermediate. If the color change is solely due to the change in dissociation due to a common ion the KBr-solution should exhibit the greatest change and the LiBr-solution the smallest. The results were found to be just the reverse, the LiBr-solution exhibiting the greatest and the KBr-solution the smallest change, while the other two gave inter-

mediate changes. The author seeks to connect these changes with the changes in the active mass of the solvent. This he does by colorimetric comparison. The lengths of liquid columns of LiBr-, NaBr-, and KBr-solutions which gave the same tint of brown were in the ratio of 14; 18.5:20 mm. respectively. The change in the active mass of the water is proportional to the change in its vapor-pressure, and these changes are approximately proportional to the freezing-point depressions of the solutions employed. The depression in the freezing-point of the solutions employed above are, according to Jones and Getman, 12°, 13½° and 19° for KBr, NaBr, and LiBr respectively. Similar results were obtained with other salts of copper as well as of cobalt, and the order in which the salts appear was likewise the same for different observers.

C. A. KRAUS.

**On the Influence of Temperature on the Amount of Water of Crystallization as a Proof for the Theory of Hydrates in Solution.** BY HARRY C. JONES AND H. P. BASSETT. *Z. phys. Chem.*, 52, 230–235.—The authors bring out several points in connection with the theory of hydrates in solution. On shaking a solution of cobalt chloride or nitrate with a considerable quantity of crystallized calcium chloride for a time, the solution gradually turns blue. Since this action cannot be ascribed to the formation of a double chloride or to a common ion effect, it is ascribed to a dehydrating effect of the calcium chloride, and the conclusion is drawn that a salt in solution may combine with more water in solution than it carries with it when it crystallizes out. The authors emphasize the fact that the stability of the hydrates increases with falling temperature. To substantiate this, they have compiled a list of salts which crystallize with varying amounts of water of crystallization, along with the temperature at which they are obtained and the number of molecules of water which they contain. In all the cases cited the number of molecules of water with which a salt separates increases as the temperature at which the salt is obtained falls. C. A. KRAUS.

**The Approximate Composition of the Hydrates Formed by Certain Electrolytes in Aqueous Solution at Different Concentrations.** BY HARRY C. JONES AND H. P. BASSETT. *Am. Chem. J.*, 33, 534–586.—From previous work which has been done on this subject, the authors conclude that if hydrates are present in solution, those substances which form the most complex hydrates in solution are the ones that crystallize out with the largest amounts of water. They give curves showing the relation between the molecular depressions of the freezing-points and concentrations of the solutions for the chlorides, bromides, iodides, and nitrates of a large number of metals. The binary salts, such as potassium chloride and ammonium nitrate, which crystallize without water of crystallization, exhibit the smallest constant of

depression of the freezing-point and this constant changes but little with concentration. Binary salts with the same number of molecules of water exhibit approximately the same constant, and this constant increases with concentration. The same holds true in an even more pronounced manner with ternary and quarternary salts. Salts of the same type with the same amount of water of crystallization give the same relation between concentration and the constant of freezing-point depression, while of salts of the same type but with different amounts of water, the salt with the greater amount of water gives the higher value of the constant. The authors communicate the results for the calculation of the amount of hydration of a large number of salts in aqueous solution. The calculations are carried out after the manner of Jones and Getman, the quantities involved being the depression of the freezing-point and the degree of dissociation, which latter quantity was determined from conductivity measurements. One point is to be noted, the concentrations are referred to the number of gram-molecules of solute per 1000 grams of solvent as a unit instead of 1000 cc. of solution, *i. e.*, to the "weight-normal" unit of Morse and Frazer (see Morse and Frazer, "Osmotic Pressure," etc., below) instead of the "volume-normal" unit. The general results are: the total amount of water held in combination by the salt increases with the concentration; the amount of water held in combination by one molecule of salt increases with dilution for some salts, while for others it passes through a maximum or approaches a limiting value as the dilution increases. An explanation of these facts is promised in a succeeding communication. For a given salt, the degree of hydration may vary from 14 to 38 in a concentration change from about 3.5 to 0.075. The investigation is to be extended. C. A. KRAUS.

**The Osmotic Pressure and Freezing-points of Solutions of Cane-sugar.** BY H. N. MORSE AND J. C. W. FRAZER. *Am. Chem. J.*, 34, 1–99.—In an earlier paper (this Journal, 24, R, 438) the authors described the preparation of the osmotic membranes and the manipulation of cells intended for the measurement of high osmotic pressures. Finding, however, that the cells prepared by the potteries do not fulfil the necessary requirements, they have undertaken their preparation in the laboratory. Although this work is as yet unfinished, for which reason a communication on the same is reserved for a later date, a number of cells of almost ideal excellence have been prepared and it is with these cells that the results of the present paper have been obtained. In preparing the membranes, the cells are first freed from air by "electrical endosmose," using a 0.005 normal solution of potassium sulphate and a potential of 110 volts. After continuing this process for seven or eight hours, the solution is replaced by distilled water and the electrolysis continued with re-

newal of water until the conductivity has been reduced to a minimum, when the cell is placed in air-free water. To form the membrane the cell is provided with a platinum cathode and filled with a 0.1 normal solution of potassium ferrocyanide while it is surrounded by a copper sulphate solution of the same strength with a copper anode. A difference of potential of 110 volts directly across the cell was found to be most favorable in forming the membrane. For a good cell the current rises rapidly to a maximum, not exceeding 100 milliamperes, after which it declines to a minimum, which may be maintained for a considerable time, when it again begins to rise. At this point, where the current begins to rise, the current is interrupted. Those cells in which the resistance rises rapidly to a high maximum which is maintained for a long time may be considered satisfactory. The resistance of such cells is approximately 100,000 ohms, although some cells with a resistance of only 30,000 ohms have given satisfactory results. It should be noted that these facts apply only to the laboratory-made cells. After this the cells are set up in a sugar solution containing 0.1 normal potassium ferrocyanide and surrounded by water containing an equivalent amount of copper sulphate. If the pressure rises rapidly to a normal maximum, the cell is considered satisfactory and is taken down to be subjected to the membrane-forming process a second time. After washing, the cell is ready to set up for final measurements.

The method of manipulation and of setting up the cell is outlined in detail and for these the reader must consult the original. The most serious difficulty experienced in the actual measurements was due to temperature fluctuations, the volume changes, due to changes in temperature, taking place more rapidly than could be equalized by the flow of water through the membrane under the corresponding pressure changes. This difficulty was to a great extent, but not altogether, eliminated by thermal insulation of the cell. In all the measurements 0.0846 gram of potassium ferrocyanide per 100 cc. was added to the sugar solution and an equivalent amount of copper sulphate to the water. After every experiment the solution was tested for inversion and the results corrected accordingly, when necessary.

Soon after beginning their experiments the authors found that the mass of the solvent plays an important part in the osmotic pressure of the solution. It appeared that a gram-molecule of a substance dissolved in a quantity of water such as to form a liter of solution is not the true normal concentration standard for osmotic pressure, but that, in the authors' own words, "*when we dissolved a gram-molecular weight of cane-sugar (342.22 grams) in 1000 grams of water, i. e., in that mass of the solvent which has the unit volume, 1 liter, at the temperature of maximum density—we found its osmotic pressure, at about 20°, in quite close accord with the pressure which a gram-molecular weight of hydrogen would*

*exert, at the same temperature, if its volume were reduced to 1 liter, i. e., to that volume which the unit mass of the solvent has at the temperature of greatest density.*" The authors therefore determine the densities of all their solutions and in their molecular weight determinations refer the concentration to this new standard of concentration which they designate as the "weight-normal" concentration. The formula for the calculation of the molecular weight becomes

$$M = \frac{W(22.488 + 0.0824t)}{P},$$

where M is the molecular weight of the solute, W is the known weight of solute per 1000 grams of water, P is the measured osmotic pressure of this solution in atmospheres, $t$ is the temperature centigrade, 22.488 is the pressure of 1 gram-molecule of hydrogen when confined to a volume of 1 liter at 0°, and $0.0824 = \frac{22.488}{273}$. Measurements were carried out with cane-sugar solutions of concentrations: 0.05, 0.01, 0.20, 0.25, 0.30, 0.40, 0.50, 0.60, 0.70, 0.80, 0.90, and 1.00 normal. Two independent series of measurements were carried out at each concentration and six or seven observations were made at different times in each series. The mean value of all results gives the molecular weight of cane-sugar, M = 341.2, the lowest value obtained being 327.9 at concentration 0.05 and the highest value being 347.7 at concentration 0.60. Some of the irregularities are doubtless due to temperature changes, while at the lower concentrations a very small error in the pressure produces a very large error in the molecular weight. Moreover, the two lowest values were obtained first, when all necessary precautions had not been taken. Taking into account the difficulties attending the experiments the results are in remarkably good accord and the authors with some reason express the view that "*cane-sugar, dissolved in water, exerts an osmotic pressure equal to that which it would exert if it were gasified at the same temperature and the volume of the gas were reduced to that of the solvent in the pure state.*" The authors further suggest that some of the abnormal freezing-points at higher concentrations may be explained by referring the concentrations to "weight-normal" units. Some preliminary freezing-point measurements were carried out with solutions of cane-sugar. They find that the formula $\Delta_1 = 1.85$ ND holds true, where $\Delta_1$ is the calculated depression of the freezing-point, N is the concentration of the solution in "weight-normal" units, and D is the density of the solution, *i. e.*, the ratio of the weights of equal volumes of solution and pure water. The agreement between the found and calculated values are remarkably good except in two cases where the deviation is not unlikely due to accidental experimental error. Further,

the osmotic pressures are calculated from the freezing-points and compared with the observed values. The agreement is satisfactory on the whole. These relations are to be tested further when more accurate measurements have been obtained. Preliminary experiments have been carried out to precipitate membranes electrolytically from other solutions than potassium ferrocyanide and copper sulphate. A considerable number of membranes have been prepared which have been shown to be useful for osmotic pressure experiments in a qualitative way. Lack of a sufficient number of good porous cells has, however, delayed quantitative tests. C. A. KRAUS.

**An Iodine Titration Voltameter.** BY D. ALBERT KREIDER. *Am. J. Sci.*, **20**, 1–10.—The author describes an iodine titration coulometer which he has perfected. The essentials of the method consist in electrolyzing a solution of potassium iodide and determining the amount of iodine liberated by titrating with sodium thiosulphate. The potassium iodide solution must be slightly acidified to prevent recombination. In order to prevent the hydrogen at the cathode from acting on the iodine, the anode was placed in the bottom of the cell surrounded by potassium iodide solution while the cathode was placed above it and surrounded by a dilute solution of hydrochloric acid. The highest current density employed was 0.058 ampere per square centimeter. The author gives the results of a series of comparisons with a silver coulometer, the anode being wrapped with filter-paper. The results by the silver coulometer are from 0.06 to 0.09 per cent. higher than by the titration coulometer, but the results by the latter do not vary among themselves by more than one part in ten thousand. C. A. KRAUS.

**The Chemistry of Electroplating.** BY WILDER D. BANCROFT. *J. Phys. Chem.*, **9**, 277–296; *J. Frank. Inst.*, **160**, 139–146.—The author discusses the influence of various factors, such as current density, temperature, concentration of, and nature of the electrolyte, upon the nature of the resulting deposit, seeking to gain a general view of their relation from a consideration of the chemistry of the processes involved. With moderate current density a bad deposit is usually due to the deposition of a compound along with the metal, the compound being in most cases an oxide, hydroxide or basic salt. Any addition to the electrolyte which dissolves such compounds tends to prevent their precipitation and thus to improve the quality of the metal deposited. The author points out that most of the substances which have been recommended as additions to the electrolyte in the precipitation of zinc, nickel, lead, tin, copper, and silver have such a solvent action in conformity with this view. The influence of acidity and of oxidizing and reducing agents cannot thus far be satisfactorily explained. The author suggests

that in part, at least, the action of reducing agents consists in the removal of dissolved oxygen. The author communicates some results obtained which substantiate the views outlined above. Fineness of deposit is favored by high current density and high potential difference, by low temperature, and by the presence of colloids. Smaller crystals are obtained from the more dilute solutions. The influence of acidity and of oxidizing and reducing agents cannot well be predicted. The author suggests that the formation of a bright deposit with a rotating cathode may be the result of a polishing action due to friction at the moment of deposition. The adhesion of the deposits the author refers back to the adherence of the two metals. "Treeing" is favored by anything which increases the fall of potential per unit length of the electrolyte or which increases the coarseness of the crystals. Surface-tension is also suggested as a possible factor.

C. A. KRAUS.

**Short Spark Discharges.** BY CARL KINSLEY. *Phil. Mag.*, 9, 692–708.—Previous investigators have observed that an irregularity occurs in the relation between spark-potential and spark length when the sparking distance is less than $3 \times 10^{-4}$ cm. The author investigates more carefully the relation between spark-potential and length for very small lengths. The distance between the platin-iridium surfaces, whose distance apart was determined by an optical interference method, was varied, in the experiments, between 3 and 500 $\mu\mu$. While it was found that the relation between the potential and the spark length is a linear one, the ratio between the two varied from day to day. For a given length the sparking-potential was greater if the surfaces were washed with alcohol before buffing with rouge. On standing, the potential would gradually fall. Values for the potential gradient could be obtained which varied between 12.5 and 83 volts per 100 $\mu\mu$, respectively. For distances under 100 $\mu\mu$ the electrodes always cohered unless the capacity was made very small. After coherence the resistance fell to a fraction of an ohm. If the electrode surfaces were now separated the resistance gradually increased approaching an exponential law very closely. The electrode distance could be increased from 100 to 800 $\mu\mu$ without causing rupture. The author concludes that a metal bridge has been formed across by the spark and, assuming this bridge to be of pure platinum, he calculates its diameter from its resistance and finds it less than $4.4 \times 10^{-6}$ cm.

C. A. KRAUS.

**A Simple Electrical Thermostat.** BY FREDERICK A. OSBORN. *J. Phys. Chem.*, 9, 297–298.—The author describes an electrically heated thermostat which is not very different from that described by Greer. The current is furnished by eight storage cells and

the heating coil is made of iron wire. The mercury regulator is wound in the form of a spiral which should be of some advantage.

C. A. KRAUS.

## ANALYTICAL CHEMISTRY.

**Electrochemical Analysis.** BY WILLIAM H. EASTON. *Chem. Eng.*, **2**, 12 (May, 1905).—A brief exposition of the value of electrochemical analysis. The paper presents no new data. It reaffirms the arguments commonly advanced in favor of the methods of electrochemical analysis. W. C. GEER.

**A Colorimetric Determination of Chromium.** BY A. MOULIN. *Chem. Eng.*, **2**, 10 (May, 1905).—A translation by J. H. DeLong of a paper published in *Bulletin de la Société de Paris* [3], **31**, 295 (March 20, 1904). W. C. GEER.

**The Determination of Copper.** BY R. L. LLOYD. *Eng. Min. J.*, **59**, 1053 (June 1, 1905, No. 22).—Apropos of numerous discussions touching the determination of copper by volumetric methods, a letter is written to the editor to show a certain volumetric method which has proven highly accurate in Mexican Mines. Electrolysis is admitted to be the most accurate method but requires time. For preliminary work where speed is an essential to the determination he uses an adaptation of a method originally described by H. A. Guess (this Journal, **24**, 708 (1902)) which is based on the reaction between potassium permanganate and thiocyanic acid. The procedure is briefly given. A carefully prepared table, checked against electrolytic determinations, is used to obtain the per cent. of copper directly from burette readings. W. C. GEER.

## ORGANIC CHEMISTRY.

**On Triphenylmethyl (Twelfth Paper).** BY M. GOMBERG AND L. H. CONE. *Ber.*, **38**, 2447–2458.—Triphenylmethyl combines with ketones, ethers, and nitriles; also, under certain conditions, with carbon disulphide and with chloroform. EXPERIMENTAL: I. *Compounds of Triphenylmethyl with Ketones.*—The triphenylmethyl was dissolved in the warm ketone, and the solution left in a cool, dark place until crystallization was completed. The following ketones were used in the experiments—acetone, methylethyl ketone, diethyl ketone, methylpropyl ketone, methylbutyl ketone, dipropyl ketone, acetylacetone, methylhexyl ketone, and acetophenone. All, except acetone, combined directly with triphenylmethyl to compounds of the type $((C_6H_5)_3C)_2 + 1$ molecule of ketone, to which the formula $(RR')\,C:O:(C(C_6H_5)_3)_2$ is assigned.

II. *Compounds of Triphenylmethyl with Ethers.*—The following ethers were used—diethyl ether, methylpropyl ether, ethylpropyl ether, dipropyl ether, methylal, phenetol, anisol, benzylethyl ether, and *o*-cresolmethyl ether. All, except dipropyl ether, combined with the hydrocarbon to form addition-products of the same general type as the ketone compounds, and of the probable structure, $(RR'):O:(C(C_6H_5)_3)_2$. III. *Compounds of Triphenylmethyl with Nitriles.*—Acetonitrile, propionitrile, and benzonitrile were treated with triphenylmethyl. With acetonitrile, no addition-product could be obtained, apparently because of the sparing solubility of the hydrocarbon in the nitrile. With propio- and benzonitriles, double compounds were easily obtained. That with propionitrile has probably the structure $C_2H_5.C\vdots N:(C(C_6H_5)_3)_2$, while the benzonitrile compound has the composition $((C_6H_5)_3C)_4.C_7H_5N$, and forms thin snowy needles. IV. *Behavior of Triphenylmethyl with Carbon Disulphide and with Chloroform.*—Under certain conditions, triphenylmethyl appears to combine also with carbon disulphide and with chloroform. V. *Constitution of Triphenylmethyl.*—After a critical discussion of the various structural formulas proposed for this hydrocarbon, the authors are of the opinion that Gomberg's early formula, $(C_6H_5)_3C$, best expresses the peculiar chemical behavior of the substance, while its dimolecular condition in solution can be explained as due to association of $(C_6H_5)_3C$ molecules.

M. T. Bogert.

**On the Use of Sodium Dioxide for the Quantitative Analysis of Organic Compounds (Second Paper).** By Hans H. Pringsheim and James A. Gibson. *Ber.*, 38, 2459–2461.—Sodium dioxide has shown itself a valuable reagent for the quantitative estimation of sulphur, halogens, phosphorus, or arsenic, in organic compounds. The authors record a number of analyses of complicated organic compounds in which the halogen was determined with this reagent, and call attention to the usefulness of the method. They have also found that sodium sulphite (or, bisulphite) and sulphuric acid are much more satisfactory as a reducing agent for the halogen oxy-salts than aqueous sulphurous acid solution. M. T. Bogert.

**On the Rearrangement of Azoxybenzaldehydes (Preliminary Paper).** By Frederick J. Alway and Walter D. Bonner. *Ber.*, 38, 2518–2520.—Human and Weil have recently described the action of concentrated sulphuric acid upon *m*- and *p*-azoxybenzaldehydes as causing the following rearrangement: $HOC.C_6H_4.N_2O.C_6H_4.COH \rightarrow HOC.C_6H_4.N:N.C_6H_4.COOH$. The authors show that this is incorrect, and that the products of the reaction are really oxyazobenzaldehydes and not benzaldehydazobenzoic acids. Experimental.—*m-Benzaldehydazobenzoic acid*, $(m)HOC.C_6H_4.N:N.C_6H_4.COOH(m)$, was prepared by

condensing *m*-nitrosobenzaldehyde with *m*-aminobenzoic acid, and also by saponifying its ethyl ester. It forms brownish yellow needles, m. p. 230° (corr.). Its salts are stable and possess no tinctorial power. Its *ethyl ester* was prepared from *m*-nitrosobenzaldehyde and *m*-aminobenzoic acid ethyl ester. It forms reddish yellow needles, m. p. 90° (corr.). Its *phenylhydrazone*, $C_6H_5.NH.N:CH.C_6H_4.N:N.C_6H_4.COOH$, is yellow and melts at 195° (corr.). *m-Oxyazobenzaldehyde*, $HOC.C_6H_4.N:N.C_6H_3(OH)COH$.—The rearrangement-product of *m*-azoxybenzaldehyde is a yellow or brownish yellow powder, m. p. 165° (corr.), difficultly soluble in cold sodium carbonate solution, easily soluble in hot. Its dilute solutions are yellow, its concentrated solutions red. It is a true dye-stuff, its alkaline solutions dyeing the skin, silk, or wool, orange. Its sodium salt is dissociated by water. Attempts to form an ester failed. The authors are inclined to believe the "ethyl ester" of Human and Weil, m. p. 156°, as only impure unchanged original substance (m. p. 165°). The compound gives a *bis-phenylhydrazone*, $C_{14}H_{10}ON_2(:N.NH.C_6H_5)_2$, brown crystals, m. p. 234° (corr.); a *dioxime*, $C_{14}H_{10}ON_2(:N.OH)_2$, brownish yellow crystals, m. p. 207–211° (corr.); and a *dianilide*, $C_{14}H_{10}ON_2(:N.C_6H_5)_2$, yellow crystals, m. p. 141° (corr.). The latter is decomposed by aqueous alcohol into a *monoanilide*, $C_{14}H_{10}O_2N_2(:N.C_6H_5)$, yellow crystals, m. p. 126–130°, and aniline. The latter anilide was also obtained by the method of Human and Weil. The above properties and derivatives establish the formula, $HOC.C_6H_4.N:N.C_6H_3(OH)COH$, for the body melting at 165°. *p-Benzaldehydeazobenzoic acid* was prepared by condensing *p*-nitrosobenzaldehyde with *p*-aminobenzoic acid, and *p*-aminobenzaldehyde with *p*-nitrosobenzoic acid. It is a reddish yellow powder, insoluble in ordinary organic solvents, and not melting below 300°. Its *ethyl ester* forms red crystals, m. p. 159° (corr.), and was prepared from *p*-nitrosobenzaldehyde and *p*-aminobenzoic acid ethyl ester, and from *p*-aminobenzaldehyde and *p*-nitrosobenzoic acid ethyl ester. *p-Oxyazobenzaldehyde.*—The product of the rearrangement of *p*-azoxybenzaldehyde is a brownish body, not melting below 300°, which dissolves in ammonia, caustic soda, or hot sodium carbonate solution, with a deep red color. It is a dye-stuff, coloring the skin, silk or wool, orange. Evaporation of the ammoniacal solution caused the separation of a *red substance*, insoluble in water.

M. T. BOGERT.

**On the Question of the Course of the Claisen Cinnamic Ester Synthesis.** BY ARTHUR MICHAEL. *Ber.*, **38**, 2523–2524.—Among the various explanations of this synthesis advanced by Claisen is the one that sodium phenyllactic acid ester is formed, whose free ester loses water on distillation, giving thereby cinnamic ester. The author has tested this experimentally, and finds that,

after acidifying the reaction product, cinnamic ester is present in the undistilled mixture. He, therefore, inclines toward another of Claisen's hypotheses, *viz.*, that sodium acetic ester is first formed and then immediately reacts with the carbonyl of the aldehyde. The recent experiments of Stoermer and Kippe throw no new light upon the question as to just when, or in what particular stage of the reaction, the water (or sodium hydroxide) is split off. M. T. BOGERT.

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## BIOLOGICAL CHEMISTRY.

**The Reversal of the Effective Stroke of the Labial Cilia of Sea-Anemones by Organic Substances.** BY G. H. PARKER. *Am. J. Physiol.*, 14, 1–7.—The effective stroke of the labial cilia in *Metridium marginatum* is not reversed by uric acid nor by creatinine, but is reversed by creatine. A $\frac{5}{8}$ N solution of sodium chloride containing $N/_{15}$ or $N/_{30}$ of creatine will cause reversal, but one containing $N/_{45}$ will not. Since vertebrate muscle contains about the same proportion of creatine as the weaker reversing fluid, it is probable that creatine is an effective element in bringing about ciliary reversal when fish-meat is applied to the lips of *Metridium*. No reversal was obtained with cane-sugar, grape-sugar, maltose, or sugar of milk. Reversal was produced by Witte's peptone, deuteroalbumose and aspartic acid. In these three instances as well as in the case of creatine, the reversal was unaccompanied by the excessive discharge of nettle capsules and of slime, and in other respects resembled the reversal produced in normal feeding. The reversal in normal feeding is due chiefly to the chemical action of organic molecules, and not to ionic action, though potassium ions, if sufficiently concentrated, will cause reversal.

F. P. UNDERHILL.

**Some New Laboratory Apparatus.** BY S. P. BEEBE AND B. H. BUXTON. *Am. J. Physiol.*, 14, 7–12.—Descriptions and plates are given of an automatic compressed air and vacuum apparatus, of a large centrifuge capable of 3000 revolutions per minute and holding a liter of fluid, of a drying apparatus and of an electric water-bath. F. P. UNDERHILL.

**Observations on the Carbohydrate Metabolism in Partially Depancreatized Dogs.** BY PERCY W. COBB. *Am. J. Physiol.*, 14, 12–16.—It is indicated that feeding meat to depancreatized dogs leads to an increase in the output of sugar in the urine.

F. P. UNDERHILL.

**Protein Metabolism in Cystinuria.** BY CARL ALSBERG AND OTTO FOLIN. *Am. J. Physiol.*, 14, 54–73.—Loewi and Neuberg (*Z. physiol. Chem.*, 43, 338) have shown that a cystinuria patient

was capable of hydrolyzing and oxidizing the cystine obtained from cystine stones, and that it was only the other kind of cystine (that found in urine or obtained from protein) which passed through the system unchanged. This difference is due, according to Neuberg, to a different chemical constitution of the two kinds of cystines. In the present investigation it is indicated that no such difference of behavior is seen when the two kinds of cystine are fed to a cystinuria patient. Contrary to the results of Loewi and Neuberg who found that their cystinuria patient was incapable of katabolizing amino acids, the experiments of Alsberg and Folin show that these compounds were readily katabolized when fed to their cystinuria patient. It was shown by feeding experiments with pure cystine that none of the cystine passed unchanged into the urine. The cystine sulphur was eliminated as sulphates, but the cystine nitrogen was apparently not eliminated as urea, but in the form of the "undetermined" nitrogen (the remainder after the sum of the ammonia nitrogen, urea nitrogen, creatinine nitrogen and uric acid nitrogen had been subtracted from the total nitrogen). F. P. UNDERHILL.

**A Study of the Comparative Effects of Solutions of Potassium, Sodium, and Calcium Chlorides on Skeletal and Heart Muscle.** BY A. E. GUENTHER. *Am. J. Physiol.*, 14, 73–105.—A supply of the ions, sodium, calcium and potassium in definite proportions, is necessary to the best maintenance of the normal activity of skeletal muscle of the frog and heart muscle of the terrapin. In physiological proportions sodium and potassium produce a condition of relaxation, while calcium produces a condition tending toward contraction, provided all three ions are present in the medium which bathes the muscle. This is true of both heart and skeletal muscle. The effects of the three ions are not necessarily the same when the ions are applied separately to fresh tissue. In isotonic solutions sodium produces a relaxation in both heart and skeletal muscle. Calcium produces a contraction in both. Potassium produces two contractions and relaxations in the sartorius, but only relaxation in a fresh strip of the terrapin's ventricle. The condition of the tissues influences the effect produced by any one ion. The effect of any one ion may be modified by the simultaneous application of other ions. The rapid contraction in skeletal muscle produced by a 1 per cent. potassium solution and the slow contraction resulting from immersion into a calcium solution are restricted to the portions immersed. The sodium twitches in skeletal muscle and the rhythmical contractions in heart muscle are at first limited to the immersed parts, but soon spread to those portions not in the solution. The contraction and relaxation produced by a potassium solution when applied to the sartorius will not occur unless both sodium and calcium are present in the tissue. The power

of potassium chloride to produce a contraction is antagonized by the presence of either sodium or calcium in the bathing medium, but the antagonism of calcium is the more marked. The effects produced by an alternation of potassium and sodium, on the one hand, and of potassium and calcium, on the other, lend support to the view that the calcium ion is more intimately associated with the contraction process than is the sodium ion. The assumption is made that there are two contractile substances in the sartorius muscle and a third in the terrapin's ventricle.

F. P. UNDERHILL.

**The Effect of Certain Salts and Dextrose on the Rate of Transformation of Glycogen into Dextrose.** BY C. HUGH NEILSON AND OLIVER P. TERRY. *Am. J. Physiol.*, 14, 105–112. —It is seen from these experiments that by increasing the dextrose, which is a product of the decomposition of glycogen, the rate of this decomposition is retarded. This agrees with the facts, that the products of a chemical reaction retard that action, and that when the blood is rich in sugar, there is a decreased transformation of the glycogen into dextrose. Calcium chloride has a retarding action, and sodium citrate an accelerating action, on the breaking up of glycogen. This agrees with the fact that such salts as sodium citrate, acetate, etc., are used as therapeutic agents to increase elimination, probably by stimulating cell activity, possibly making the cell more permeable. F. P. UNDERHILL.

**The Excretion of Nitrogen by the White Rat as Affected by Age and Body Weight.** BY SHINKISHI HATAI. *Am. J. Physiol.*, 14, 120–133.—From observations on eighty-nine male rats at different ages and weights, the following results were obtained. The total amount of urine increases with the weight up to 120 grams then decreases very decidedly; from 180 grams it again increases up to 220 grams beyond which weight it remains rather constant. A diminution of urine in animals between 120 to 180 grams or approximately 70–125 days old seems to be a normal phenomenon rather than mere statistical variation. Whether or not this is a phenomenon of adolescence needs further investigation. It must be noted, however, that puberty in the rat begins at about seventy days after birth. The smaller animals excrete a relatively greater quantity of urine than the larger ones. The total amount of nitrogen is quite independent of the amount of urine, and increases constantly and continuously throughout life. It increases with the weight. The smaller rats, however, excrete a relatively greater quantity than the larger animals; the percentage value of urinary nitrogen is 91 per cent. of the total in the case of smaller animals and 89 per cent. in that of the larger. The total amount of nitrogen eliminated by the rat during twenty-four hours at different weights may be

determined with a high degree of accuracy by the following formula:

$$N = 10^{\frac{233 + (3 \times \log B.W.)}{4}} \text{ or } \log N = \frac{233 + (3 \times \log. B.W.)}{4}$$

where N = total nitrogen in milligrams and B. W. = body weight in grams. F. P. UNDERHILL.

**On the Masking of Familiar Ionic Effects by Organic Substances in Solutions.** BY PERCY GOLDTHWAITE STILES AND WILLIAM HERBERT BEERS. *Am. J. Physiol.*, 14, 133–138.—The results of about fifty experiments indicate that the effect of a given amount of a salt upon the tone of any of the contractile tissues employed is much obscured by the organic bodies when these are present. To make the response of the preparation in such a solution equal to that of its fellow in a simple inorganic mixture, from two to four times as much of the stimulating or depressing agent must be added. This masking of ionic effects upon living tissue by organic bodies may be taken as an indication of combination where it is difficult to obtain evidence upon the matter by the usual chemical methods. F. P. UNDERHILL.

**The Solubility of Globulin in Salt Solution.** BY THOMAS B. OSBORNE AND ISAAC F. HARRIS. *Am. J. Physiol.*, 14, 151–172.—It is possible to determine quantitatively the solvent power of salt solutions on the globulin, edestin, with sufficient accuracy to obtain valuable information respecting the relative solvent powers of these salts. Two distinct forms of solution result where saline solutions are applied to edestin, one which requires the presence of a relatively large quantity of salt before notable quantities of the globulin dissolve, and from which edestin is precipitated unchanged by dilution with much water, as well as by the addition of small quantities of strong acids; the other, which is caused by relatively very small quantities of the salt, is not precipitated by dilution with water or by dialysis, nor by small quantities of acids, and from these solutions the edestin has not been separated unchanged, as the positive ion enters into combination with it. Solutions of the first kind are produced by neutral salts of strong bases with strong acids, those of the second kind by solutions of salts of weak bases, and therefore closely resemble solutions in pure acids. Saline solutions of edestin are strongly influenced by the presence of minute quantities of other substances, especially bases and acids. The primary compound of edestin with acids, that is, the salts of edestin such as the chlorides and sulphates are less soluble than the free edestin. Equal quantities of normal solutions of most salts of strong bases with strong acids have equal solvent power; those tested and found to follow this law were sodium, potassium, caesium, ammonium, barium, strontium, calcium and magnesium chlorides,

and sodium, potassium, lithium, and magnesium sulphates. Those found to be exceptions were the nitrates of sodium, potassium, calcium and strontium, the chloride of lithium, the bromides of sodium, potassium, barium, calcium, and lithium, and the iodides of sodium and potassium. The solubility of edestin in solutions of salts of strong bases with strong acids resembles the solubility of certain insoluble inorganic salts in solutions of other salts, in consequence of the formation of complex salts in solution. It seems reasonable, therefore, to assume that soluble addition products of the globulin and salts are also formed. Salts of strong bases with weak acids have a greater solvent power than similar salts containing strong acids. The solvent power of such salts was found to be in the order named: sodium carbonate, potassium chromate, sodium sulphite and sodium thiosulphate. Salts of weak bases with strong acids have a lesser solvent power than similar salts with strong bases. The solvent power of such salts was in the following order: manganese chloride, manganese sulphate and ferrous sulphate. The behavior of edestin toward acetate solutions is anomalous. Salts of the heavy metals combined with strong acids behave like a mixture of a neutral salt with free acid, as for example, a mixture of sodium chloride and hydrochloric acid. Ferric chloride is an exception, behaving much like free hydrochloric acid. F. P. UNDERHILL.

**On the Hexone Bases of Liver Tissue under Normal and Certain Pathological Conditions.** BY ALFRED J. WAKEMAN. *J. Expt. Med.*, 7, 292–304.—Author shows that the individual hexone bases of dogs' liver are reduced both in phosphorus poisoning and by poisoning with chloroform. The results reported lead to the conclusion that while in the degenerating cells chemical changes are taking place tending toward a diminution of the hexone bases as a whole, they affect the arginine especially.

F. P. UNDERHILL.

**Enzymes and Anti-enzymes of Inflammatory Exudates.** BY EUGENE L. OPIE. *J. Expt. Med.*, 7, 316-335.—The serum of an inflammatory exudate has the power of inhibiting the action of proteolytic ferments contained in the leucocytes. This anti-enzymotic power is possessed by the blood serum from which it doubtless passes into the exudate. In the later stages of inflammation, there is some reduction of this anti-enzymotic action. The anti-body in the serum is destroyed by a temperature of 75° C. The proteolytic ferments of the leucocytes act both in an acid and in an alkaline medium but are most efficient in the latter. The anti-enzymotic action of the serum is favored by an alkaline reaction, but is completely lost in an acid medium.

F. P. UNDERHILL.

**A Preliminary Report on the Pasteurized and Clean Milk of**

**Philadelphia.** BY M. E. PENNINGTON AND J. A. MCCLINTOCK. *Am. J. Med. Sci.*, **130**, 140–150.—During May and June, 1904, counts of clean ("certified") milk and of commercial Pasteurized milk showed that the latter was richer in organisms on the initial examination and that a rapid increase in the organisms present took place on keeping, even at refrigerator temperatures. Pasteurized modified milk, for infant feeding, showed frequently an appalling initial count and almost invariably a very high count at the end of twenty-four hours. The commercial Pasteurizing plants succeed in reducing the original bacterial content of the milk to a very low figure in the heating coils, but again contaminate it in the cooling and bottling of the milk so that sometimes the final count is higher than that of the original unpasteurized milk. F. P. UNDERHILL.

**Sulphonated Guaiacol Compounds.** BY H. C. JACKSON AND GEORGE B. WALLACE. *Med. News*, **87**, 159–161.—Experiments carried out upon dogs show that guaiamol (guaiacol ammonium sulphate) is not an antiseptic nor is it broken up by the pancreatic juice. After absorption it is decomposed to such a slight extent that no action due to liberated guaiacol could occur.

F. P. UNDERHILL.

**The Bacterial Content of the Railway Coach.** BY J. J. KINYOUN. *Med. News*, **87**, 193–199.—The examination included the bacterial content of dust from carpets, the bacteria obtained from the interior furnishing of the coach, the bacterial content of the air of the coach, the bacteria of the drinking cup, methods of cleansing the railway coach and observations on the health of the employees. Inoculations of animals (guinea pigs) with the bacteria obtained from the various sources gave the following results:

| | Carpet dust. | Swabs (in cleaning). | Air. | Drinking-cup. |
|---|---|---|---|---|
| Negative | 8 | 43 | 76 | 17 |
| Pneumococcus | 2 | 5 | 8 | 1 |
| Staphylococcus pyogenes aureus | 3 | 2 | 4 | 1 |
| Streptococcus pyogenes | .. | 2 | 1 | 1 |
| Bacillus tuberculosis | .. | 1(?) | 1 | .. |
| Streptothrix | .. | 1 | .. | .. |
| Colon infection | .. | 2 | .. | .. |
| Diphtheria | .. | 1 | .. | 1 |
| Septicemia | 1 | 6 | 1 | .. |

F. P. UNDERHILL.

**Studies on the Toxicity of the Bile. I. The Effects of Intravenous Injections of Bile upon Blood-pressure.** BY S. J. MELTZER AND WILLIAM SALANT. *J. Expt. Med.*, **7**, 280–292.—The authors find that the contradictory statements in the literature on the influence of bile upon the blood-pressure can be explained by the rate of injection. When injected slowly a fall of

pressure may not be observed, but if injected rapidly the pressure is reduced considerably. The fall of pressure is shown to be due to specific effects of the bile and not to mechanical causes. The view is put forward as a result of experimental observations that bile stops the heart by inhibiting its activity. It does this, however, without influencing the vagus. F. P. UNDERHILL.

**Recent Advances in Physiological Chemistry.** BY J. H. LONG. *Science*, 22, 129–137. F. P. UNDERHILL.

**Theories of Metabolism.** BY GRAHAM LUSK. *Science*, 22, 6–13. F. P. UNDERHILL.

**The Action of the Active Principle of Jamaica Dogwood.** BY M. VEJUX-TYRODE AND LOUIS NELSON. *Arch. internat. de Pharmacodynamie et de Thérapie*, 14, 52–74.—Piscideine, the active principle of Jamaica dogwood, has long been used as a therapeutic agent as a cure for consumption and as a narcotic. The present authors find that it has no therapeutic value whatever. It is indeed dangerous to use in this respect since it may produce collapse. It greatly resembles physostigmine in its action.
F. P. UNDERHILL.

**Immunity and Adaptation.** BY LEO LOEB. *Biol. Bull.*, 9, 141–152. F. P. UNDERHILL.

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## INDUSTRIAL CHEMISTRY.

**The Effect of Alkaline Scouring Agents on the Strength of Woolen Yarns.** BY J. MERRITT MATTHEWS, PH.D. *J. Soc. Chem. Ind.*, June 30, 1905.—The yarn used for his experiments by the author was a medium grade of woolen yarn, carded and spun with an emulsion containing lard oil and borax. Before scouring, it contained about 0.1 per cent. of iron, and the amount of grease and miscellaneous dirt was 6 per cent. Skeins weighing about 5 grams and containing 23 strands were used, the scouring being carried out in each case for twenty minutes. The effect of different scouring agents is given in detail, in which different temperatures and different concentrations of scouring solutions were used. The agents employed were hot water, soap solutions, soda-ash, caustic soda, ammonia, and borax solutions. It was found that a temperature of 140° F. was the most satisfactory for use with soap solutions, as up to that point complete scouring could not be obtained, and increase in temperature did not improve the results. The tabulation as here given will therefore be confined in the main to results at 140° F.

| | Grams per liter. | Strength. Per cent. | Loss in per cent. | Elasticity. Per cent. | Loss in per cent. | Loss in weight. Per cent. | Remarks. |
|---|---|---|---|---|---|---|---|
| Hot water....... | ..... | 28.5 | ...... | 19.0 | ...... | .... | contains iron |
| Soap solution. | 5.0 | 12.6 | 55.9 | 18.0 | 5.0 | 5.7 | no iron |
| Soda-ash........ | 15.0 | 18.0 | 37.0 | 17.0 | 10.0 | 5.6 | iron |
| " " ........ | 5.0 | 14.1 | 50.0 | 16.0 | 16.0 | 4.8 | " |
| Caustic soda .. | 0.1 | 16.1 | 43.0 | 17.0 | 10.0 | 2.0 | " |
| " " .. | 0.5 | 12.4 | 56.0 | 11.0 | 44.0 | 8.7 | " |
| Ammonia...... | 5.0 | 16.2 | 43.0 | 19.0 | 00.0 | 4.6 | " |
| " ...... | 10.0 | 16.4 | 42.0 | 17.0 | 10.0 | 6.1 | " |
| Borax .......... | 1.0 | 14.0 | 51.0 | 17.0 | 10.0 | 4.4 | " |
| " ............ | 10.0 | 16.2 | 43.0 | 18.0 | 5.0 | 4.8 | " |

An important point made by the author is that in soap-scouring, all the iron is removed from the fiber when a temperature of 140° is reached, while in all other cases the iron is not removed. With caustic soda solutions, with the strength even as little as 0.1 gram per liter, the alkali has a destructive effect upon wool at temperatures above 140°. He calls attention, therefore, to the danger of caustic alkali in scouring-soaps, which in many cases would be as much as this concentration. The results with ammonia show that results in practice are not up to claims usually made in text-books, as complete removal of the grease is not effected until the strength of 10 grams of ammonia per liter is reached, and the emulsification of the grease and dirt does not appear to be as perfect with ammonia as with plain soap. Furthermore, the ammonia fixes the iron compounds in the fiber and leaves the wool with a brownish tint. As a result the author believes soap scouring to be the most efficient, when not aided with any alkali whatever. The statement frequently made that wool oil should be as free as possible from unsaponifiable matter is a mistaken one, as wool fat itself is very largely unsaponifiable yet is easily removed by soap solutions. The scouring quality of wool oil is dependent alone upon the readiness with which it forms an emulsion with water and soap or alkaline solutions, and not upon its property of being saponifiable. The author believes that a factor of an oil which should be determined is an emulsification equivalent. This determination he effects as follows: "A skein of woolen yarn, spun with the emulsion under examination, is weighed and then scoured for twenty minutes at a temperature of 140° F. in a solution containing 5 grams of soap per liter; on washing, drying and reweighing the total loss on scouring is obtained. A similar weighed skein of yarn is then scoured for twenty minutes in plain water at a temperature of 140° F., after which it is dried and reweighed and the loss determined. The ratio between the first and second values obtained in this manner will give a crude practical idea of the emulsifying property of the oil on the fiber. In the experiments described in the first part of this paper, for example, we have the following data:

| | Per cent. |
|---|---|
| Loss with soap solutions | 5.7 |
| Loss with warm water | 2.2 |
| Emulsification equivalent = 2.2 + 5.7 | 38.0 |

The numerical value of the emulsification equivalent without reference to the fiber has not yet been decided upon by the author. In conclusion, it is said that an oil which is easily emulsified with soap solutions at temperatures not higher than 140° F., other conditions being proper, may be considered as a good wool oil irrespective of the fact whether it contains unsaponifiable matter or not. S. P. SADTLER.

**Gas as a Source of Power.** BY WILLARD E. CASE, DR. OSKAR NAGEL, C. G. ATWATER, AND J. D. PENNOCK. *J. Soc. Chem. Ind.*, June 15, 1905.

GENERATION OF PRODUCER, MOND AND BLAST-FURNACE GASES.

WILLARD E. CASE.

The gas engine has demonstrated its ability to work successfully with all our commercial gases, producing a conversion efficiency greatly in excess of that obtained by any other heat motor. The future progress of the gas engine depends upon the blast-furnace gas, coke oven gases, and producer gases. Briefly, the gas to be desired is one that is uniform in quality and clean, containing a low percentage of hydrogen and inert gases, one that is capable of production in a plant of the least complexity of apparatus and greatest simplicity of operation, and made from the most readily available fuels at the least possible cost.

To secure a uniform gas it is necessary that the operation should be continuous rather than intermittent. To secure a clean gas, the gasification of the fuel should be wholly completed within the generator so that no cleaning apparatus other than a simple scrubber for the purpose of removing fine dust should be required.

All fuel may be converted into gas, but the combustibility of the fuel depends upon the nature of the materials used and the methods of their gasification.

The commercial gases in use are natural gas, retort gas, water gas, oil gas, carburetted water gas, producer gas, coke-oven gas and blast-furnace gas. These gases differ from each other in the proportion of their constituent gases, which are oxygen, hydrogen, carbon dioxide, carbon monoxide, methane, ethylene, nitrogen and sulphur in small quantities. Oxygen is not to be considered as having any heating value. Hydrogen appears either as free hydrogen or combined with carbon as hydrocarbon. It has a calorific value of 320 B. T. U. per cubic foot. Carbon dioxide acts only as a diluent in reducing the calorific value of the mixture. Carbon monoxide has the same calorific value as hydrogen, 320 B. T. U. per cubic foot. Methane has a calorific value of 1000 B. T. U. per cubic foot. It is a slow burning gas and for this

reason a particularly desirable one in engine use. Ethylene has a calorific value of 1600 B. T. U. but appears to only a small extent in commercial gases. Nitrogen and sulphur have no heat value, and act as diluents.

The following are given as typical analyses of commercial gases:

| | Natural gas. | Retort gas. | Water gas. | Oil gas. | Carburetted water gas. |
|---|---|---|---|---|---|
| Hydrogen | 3.0 | 46.0 | 48.0 | 32.0 | 40.0 |
| Methane | 92.0 | 40.0 | 2.0 | 48.0 | 25.0 |
| Ethylene | 3.0 | 5.0 | ...... | 16.5 | 8.5 |
| Carbon monoxide | ...... | 6.0 | 38.0 | ...... | 19.0 |
| Carbon dioxide | ...... | 0.5 | 6.0 | ...... | 3.0 |
| Nitrogen | 2.0 | 2.0 | 5.5 | 3.0 | 4.0 |
| Oxygen | ...... | 0.5 | 0.5 | 0.5 | 0.5 |
| Cal. value per cubic foot | 1000 | 660 | 295 | 846 | 575 |
| Amt. of air required per cubic foot for combustion | 9.73 | 6.05 | 2.35 | 8.07 | 5.25 |

| | Producer gas from Anthracite. | Producer gas from Bituminous. | Producer gas from Coke. | Coke-oven gas. | Blast-furnace gas. |
|---|---|---|---|---|---|
| Hydrogen | 20.0 | 10.0 | 10.0 | 50.0 | 1.0 |
| Methane | ...... | 3.0 | ...... | 36.6 | ...... |
| Ethylene | ...... | 0.5 | ...... | 44.0 | ...... |
| Carbon monoxide | 25.0 | 23.0 | 29.0 | 6.0 | 27.5 |
| Nitrogen | 49.5 | 58.0 | 56.0 | 2.0 | 60.0 |
| Oxygen | 0.5 | 0.5 | 0.5 | 0.5 | ...... |
| Cal. value per cubic foot | 144 | 144 | 123 | 603 | 91 |
| Amt. of air required per cubic foot for combustion | 1.12 | 1.2 | 0.08 | 5.6 | 0.72 |

Natural gas is restricted to special localities. Coke-oven and blast-furnace gases are very desirable, but being products of industrial operations are subject in their use to the same. Bench gas, oil gas, and carburetted water gas are all good engine gases, but are too costly for general use. Water gas, as made in America at least, is too expensive for general use, owing to the cost of raw fuel and the limited efficiency of the producing systems; in addition to this is the apparent difficulty of its pre-ignition and back firing in the engine cylinder, due to its high percentage of hydrogen. This prevents sufficient compression for high efficiency.

The efficiency of various producer gases ranges from 70 to 85 per cent., depending upon the design of producer and its ability in completing the gasification of heavy hydrocarbon distillates.

The process of making producer gas in general consists in simply passing air or air and steam through a body of fuel enclosed in a suitable brick-lined generator; the process is usually a continuous one, the fuel being fed in as needed and the steam and air blast being introduced simultaneously. Where coke or anthracite coal is used, the gas comes off comparatively clean.

In general it may be said that whatever the nature of the gas used, an engine of proper design will consume 10,000 to 12,000 B. T. U. per brake horse-power per hour at or near full load. With producer gas at 125 B. T. U. per cubic foot, the average value of

anthracite gas, the consumption will approximate 80 cubic feet per brake horse-power hour.

One pound of coal should give about one indicated horse-power hour. When not in use, the losses in such a plant are small, the consumption of coal averaging about 3 pounds of coal per hour in plants averaging only 250 horse-power.

*Mond Gas.*

Mond gas is a producer gas containing an ammonia recovery system.

The coal used must not be of a strong, coky nature, and should be one rich in nitrogen. The advantage of the system is that a cheap coal may be used, and a valuable product recovered, but the plant is necessarily an expensive one, due to the large amount of apparatus used.

The producer is provided with a water seal, so as to allow the ash which is the only residue, to descend into the water, from which it is easily removed without interfering with the operation of the producer.

The temperature of operation is comparatively low, so as to prevent formation of clinkers and the destruction of ammonia. The amount of steam used to recover the ammonia from the gas is equal to 2.5 tons per ton of fuel gasified, but of this amount about one ton is automatically recovered and used over again.

After leaving the producer, the gas is used to heat air and steam to be used in the producer. From here it goes to a mechanical washer, which reduces the temperature and removes all soot and dust. It then goes to the ammonia recovery plant where the ammonia is absorbed by a dilute solution of sulphuric acid until the solution contains from 36 to 38 per cent. of ammonium sulphate.

This method of continuously employing the water in circulation as the heat-carrying agent between the hot gas in one tower and the cold air in another, and the method of recovering, from the hot gas, by this continuous change of heat, a large proportion of the steam required for the producer blast are important features in the economy of this process.

The Mond system for a power plant under 5,000 horse-power does not warrant the installation of the ammonia recovery process.

The following are typical analyses of Mond gas, being the average of several analyses from plants with and without the recovery system.

| | Without ammonia recovery. | With recovery. |
|---|---|---|
| $CO$ | 11.0 | 13.8 |
| $H$ | 27.5 | 24.3 |
| $CH_4$ | 2.0 | 2.0 |
| $CO_2$ | 16.5 | 13.9 |
| $N + H_2O$ | 43.0 | 46.0 |
| | 100.0 | 100.0 |
| Total combustible in the gases | 40.5 | 40.1 |
| Calorific value | 145.6 | 144.2 |

The coal used was slack, with an average analysis in both instances of:

| | Per cent. |
|---|---|
| Moisture at 100° C. | 8.6 |
| Volatile matter (excluding carbon) | 18.29 |
| Total carbon | 62.69 |
| Ash | 10.42 |
| | 100.00 |

The fuel conversion efficiency does not fall short of 80 per cent. The standby losses for a 1,000 horse-power plant are about 225 pounds of fuel per night of fourteen hours. At the end of a week the time required for starting is only about three minutes.

For a 20,000 horse-power plant in continuous operation, the production of ammonium sulphate will approximate nearly 3,000 tons per year. The net profits of this after deducting all costs of production will approximate $1.75 per gross ton of fuel gasified.

*Blast-furnace Gases.*

To produce one ton (2000 pounds) of pig iron requires a furnace charge of

| | Lbs. |
|---|---|
| Ore (93.5 per cent. iron) | 3,400 |
| Coke (85 per cent. fixed carbon) | 2,000 |
| Limestone (42 per cent. $CO_2$) | 1,000 |

with average analyses of ore, coke and limestone.

According to a calculation made by the author, for every ton of iron produced there would be involved 141,000 cubic feet of gas. Of this gas, 28.3 per cent. is combustible, having a heating value of 90 B. T. U. per cubic foot or total heating value of 12,690,000 B. T. U. per ton of fuel. About half the heating value of the coke used is contained in this gas. Of this gas about 15 per cent. of the original heating value of the coke is used for heating the blast.

After reducing these figures to brake horse-power hours, there are 700 brake horse-power hours available in the gas evolved from the production of one ton of pig iron.

## UTILIZATION OF GAS FROM SUCTION PRODUCERS.

By Dr. Oskar Nagel.

Instead of passing steam from a separate boiler through producers, the so-called suction producers have been introduced. The essential feature of this is that the water is evaporated by means of the otherwise waste heat of the producers, by having the boiler situated as a water-jacket very close to the producer, so as to utilize the heat passing off from the same.

The cost of installation with this arrangement is much less and the space taken up is also considerably less. The steam is drawn from the boiler through a bed of coals only as is made necessary by the wants of the gas engine, and thus made automatic by suction. The fuel economy with suction producers

reaches and exceeds 80 per cent., which is better than with pressure producers. There is also no danger due to leakage of gas as is the case with the older type of producers. As the gas comes directly from the producer, there is no necessity of the use of gas-holders. It is easy to start, and, as indicated above, runs practically automatically.

A complete suction gas producer plant consists of a blower, which up to 150 horse-power is driven by hand, a producer, an evaporator, an overflow water-pot, a scrubber and a small equalizing tank. In plants above 75 horse-power a sawdust scrubber is advantageously inserted behind the wet scrubber, and in plants where two or more engines are fed from the same producer a small gas-holder with automatic regulation is used.

The grate area of the producer is from 0.8 to 1 square foot for every 10 horse-power. The scrubber is made of sheet iron and filled with broken coke. It has a capacity of at least 1 cubic foot for every horse-power.

The producer is started by means of a blower until the gas is burning well at the test cock. When this point is reached, the blower is stopped and the engine started in the usual way. From then on the engine sucks the amount of air and steam necessary through the fuel, and thus produces its own gas.

Anthracite, charcoal or coke can be used equally well in the suction producer. According to the amount of ash, it will take from one to one and a quarter pounds of anthracite or charcoal, or one and a quarter to one and a third pounds of coke for developing one horse-power hour. With anthracite (pea) at $5 per ton, one horse-power hour will cost about a quarter of a cent. This is about one-sixth the cost of illuminating gas power at a price of 75 cents per thousand cubic feet.

## COKE-OVEN GAS.

By C. G. Atwater.

The production of coke-oven gas is distinguished from producer gases in that it is the result of the destructive distillation of bituminous coal with the exclusion of air. The primary object in such distillation is the production of coke.

Analyses of coals used, description of the plant including a cut and diagram showing the operation of gas engines at the Theresia Colliery are given, and also the production of coke for 1903.

With reference to the operation of the by-product ovens, generally fifty are arranged in a battery with a sub-structure of steel and concrete. The ovens are heated by gas, which is either the poorer portions of the gas evolved, or in some cases where the demand for illuminating purposes is great, it is made by producers. The air entering and the gas leaving the flues are made to pass through the well-known Siemens regenerative checker-work construction.

The coal is elevated to bins above the ovens and filled by means of a larry which passes over the ovens. The coke is pushed from the ovens by means of a mechanical ram and then quenched.

The gas evolved is taken up by two mains, one for rich gas, which is something more than one-third of the total gas evolved and has a heat value of over 650 B. T. U. per cubic foot, while the poorer gas which comes off subsequently has a heating value of 500 to 600 B. T. U. per cubic foot. These gases are scrubbed and purified in the usual manner.

For use in gas engines, it is endeavored to have coal containing such an amount of sulphur that no oxide purification is required.

The crude ammonia liquor contains 14 to 18 per cent. of ammonia. In some cases after the vapors are passed through sulphuric acid, sulphate of ammonium is formed. At the Theresian Schacht Plant at Polnisch Ostrau, Austria, three 300 horse-power gas engines operate the coke-oven gas. These engines are 4-cycled and the gas used in them is scrubbed with water and sawdust but not treated with oxide. These engines were guaranteed to deliver 1 horse-power per hour from 27 cubic feet of gas, with a maximum value of 329 B. T. U. per horse-power hour, which guarantee was fulfilled. The graphical chart contained in this article shows the few stops for repairs, etc., that have been necessary in the operation of this engine.

### THE MOND PRODUCER.

BY DR. J. D. PENNOCK.

In describing the plant of the Solvay Process Company at Detroit, at which the first Mond producer plant in the United States was installed in 1897, the operation of 6 Mond and 2 modified Mond producers is described.

110 tons of coal are gasified per day at this plant. The coal used for the Mond producer must be non-clinkering and high in nitrogen so as to produce a fair proportion of ammonia. The coal selected for this purpose was Hocking Valley nut coal, of which the analysis is here given and compared with the English producer coal.

| | Hocking Valley nut coal. | English producer coal. |
|---|---|---|
| Moisture (chemically combined) ... | 7.84 | 6.85 |
| Volatile matter........................... | 27.95 | 33.14 |
| Fixed carbon............................... | 50.75 | 48.93 |
| Ash........................................... | 13.46 | 11.10 |
| Sulphur..................................... | 1.50 | 1.68 |
| Nitrogen........ .......................... | 1.45 | 1.35 |

Analyses of the Mond gas produced from these coals are given in the following table:

MOND GAS.

| | Detroit. | England. |
|---|---|---|
| Carbon dioxide | 14.6 | 16.5 |
| Oxygen | 0.5 | ...... |
| Carbon monoxide | 10.3 | 11.0 |
| Methane | 5.3 | 2.0 |
| Hydrogen | 23.5 | 27.5 |
| Nitrogen | 55.8 | 43.0 |
| Total combustible | 39.1 | 40.5 |
| Gross B. T. U. per cubic foot | 163.5 | 145.5 |
| Net B. T. U. per cubic foot | 146.6 | 129.7 |

The yield of ammonia amounts to from 70 to 75 pounds of sulphate per long ton of coal.

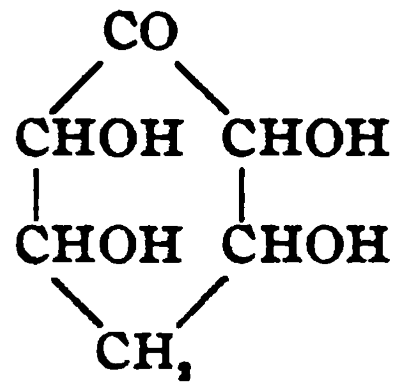
**Some Problems in the Cellulose Field.** BY ALVIN S. WHEELER. *Chem. Eng.*, July, 1905.—The reactions in the vegetable cell are referred to as being very complex and perfect in efficiency, and yet the range of temperatures is very narrow, it being quite in contrast with reactions carried out in manufacturing practice where high temperatures are generally necessary for complete reactions of an organic nature.

It is suggested that in the plant cell where synthetical operations are predominant, foundations of the "new chemistry" will have to be looked for. The cellulose of cell walls is not identical in all cases as the ultimate products of hydrolysis show. Cotton yields dextrose; the cell walls in many plants give galactose, and the seeds of cereals and leguminous plants yield arabinose and xylose. The chemistry of cellulose is further made complex by the addition compounds forming lignocelluloses, mucocelluloses, pectocelluloses, adipocelluloses and cutocelluloses. The difficulties met with in the experimental study of cellulose are due mainly to the solubility of cellulose which prevents freezing- and boiling-point determinations.

An interesting point has been found with reference to the group of celluloses that the white insoluble substance found in beet juice, having the character of cellulose, if transferred to pure cane-sugar, is augmented in amount. It seems from this that cane-sugar is the predecessor of cellulose, and not starch as had been previously thought to be the case. The starch seemed to be a cellulose reserve to be drawn upon in case of starvation of the cell when cane-sugar was not present.

Cellulose has a great affinity for water, cotton cellulose retaining from 6 to 12 per cent. in the air-dried condition, which, when driven off, will be reabsorbed on exposure to the atmosphere. Judging from the fact that the tetracetate is the highest normal acetate, it is possible that there are four hydroxyl groups, and, due to the large proportion of acetic acid obtained when cellulose is fused with alkaline hydroxides, the presence of $COCH_2$ groups is indicated.

It is the belief of many investigators that cellulose does not belong to the open-chain hydrocarbons as sugar and starch, but has a ring structure, to explain which several formulas have been advanced, that of Cross and Bevan being the most prominent.



Cross and Bevan formula.

In dyeing cellulose, it behaves like a weak acid, especially when converted into oxycellulose (when treated with basic dyes). When cotton is treated with ammonia under certain circumstances, as much as 2.86 per cent. of nitrogen has been taken up which is not extracted with dilute hydrochloric acid. The compound then possesses basic properties as it will take up an acid dye from an acid bath.

When cellulose undergoes oxidation with hydrolysis such as the action of hydrogen peroxide upon filter-paper, the compound is called hydralcellulose. This bears same relation to cellulose as glucose does to cane-sugar.

There is a considerable difference of opinion as to what is the constitution of oxycellulose.

Some work has been done on the fermentation of cellulose by the author and he is going on with such investigations. It is supposed that in the fermentation of cellulose, alcohol is formed as an intermediate product, which may be regarded as a subject of considerable commercial importance.

When cellulose is decomposed by chemical reagents, oxalic acid, alcohol and sugar have been formed.

The largest utilization of cellulose is for paper stock. Derivatives of cellulose that find extensive application are nitrocellulose for explosives, artificial silk and celluloid, and the thiocarbonate for artificial silk. The tetracetate has been found to possess insulating properties superior to gutta percha.

S. P. Sadtler.

**The Utilization of Peat.** *Eng. Min. J.*, July 15, 1905.—A description of the work of producing peat blocks at New Rochelle, N. Y., is given.

About 25 acres of bog are available at this place. The average depth is 27 feet and the peat is considered better than any found in the famous Bavarian localities. The plant used is movable and is driven by a Hornby-Ackroyd kerosene engine of 15 horsepower, using $1.75 worth of gasoline per day of ten hours. An 18-inch gauge tract is used and the drainage is effected by means of

ditches 4 feet deep. The water is lifted from these over a dyke by means of a gasoline-driven centrifugal pump. The peat is disintegrated and crowded by a screw into rectangular strands which are cut into blocks a foot long. These at first contain 85 per cent. of water. They then lose 10 per cent. of the water in two hours, when they can be handled without breaking.

In eighteen days the amount of water contained is reduced to 12 per cent. of chemically combined water. The blocks shrink from a volume of 120 cu. in. and a weight of 6 pounds to 24 cu. in. and a weight of 1.3 pounds. The daily output is 30 to 35 tons at a cost of $1.50 to $1.75 per ton. S. P. SADTLER.

**Bituminous Coal Production in 1904.** *Eng. Min. J.*, July 15, 1905.—Table taken from report of mine inspectors :

| | Total No. employees. | Total number tons mined (short tons). | Tons mined to each employee. |
|---|---|---|---|
| Pennsylvania | 155,569 | 99,600,167 | 640.2 |
| Illinois | 54,744 | 37,077,897 | 676.9 |
| West Virginia | 41,981 | 30,222,881 | 719.0 |
| Ohio | 45,834 | 24,583,815 | 536.3 |
| Alabama | 17,850 | 11,273,151 | 631.5 |
| Indiana | 17,838 | 9,872,404 | 553.4 |
| Kentucky | 13,679 | 7,108,594 | 519.6 |
| Colorado | 10,769 | 6,766,551 | 629.2 |
| Maryland | 5,996 | 4,277,196 | 713.4 |
| Missouri | 9,875 | 4,115,695 | 416.7 |
| Washington | 4,633 | 2,905,689 | 627.1 |
| Utah | 2,215 | 1,563,274 | 705.7 |
| Total | 380,911 | 239,538,695 | ...... |
| Penna. (anthracite) | 161,330 | 73,594,369 | 456.1 |

S. P. SADTLER.

## AGRICULTURAL CHEMISTRY.

**The Quantitative Analysis of Lard.** BY DAVID WESSON AND NATHANIEL J. LANE. *J. Soc. Chem. Ind.*, 24, No. 13, July 15, 1905.—It is suggested that a preliminary examination be made by means of the Halphen test and the Bechi test, and that a microscopical examination be made of the crystals separating from the ether solution. The following quantitative methods are also suggested as important: Free acid as oleic (Wesson's method); the modification of the Delican titer test; saponification value; the iodine value (Hübl or Wijs' not Hanus); the liquid acids and their iodine value ; and Wesson's cooling test. In all cases the exact methods preferred by the authors are given in detail. W. D. BIGELOW.

**Food Inspection.** BY H. E. BARNARD. Vol. II, p. 118, *New Hampshire Sanitary Bull.* 8, July 1905.—A detailed report is

given of the results obtained in the examination of 426 samples of food. Of the total number examined in the laboratory, 236, or 55.4 per cent., were found to vary from the legal standard. The high percentage of illegal goods is explained by the fact that the samples were chosen from portions of the state that had not been previously visited by the inspectors of the board of health. The dealers visited were for the most part not familiar with the work of the board. In the section of the state visited the food products were largely supplied to the grocers by wholesalers residing in a state in which no food law has been enforced. W. D. BIGELOW.

**The Detection of Cane-sugar in Maple Products.** BY A. G. WOODMAN. *Tech. Quart.*, **18**, June, 1905.—The author compares the methods for the examination of maple sugar suggested by Hortvet, Jones, and Hill and Mosher. Several tables are included in which are given his own results and those of others with maple syrup and sugar of known purity. He suggests that the Hortvet method is of great value for the purpose of "sorting out," but that these results are not as characteristic as those obtained by the other methods. The Hill and Mosher test he finds tedious and disagreeable but obtains characteristic results by its use. On the whole, the Jones method, including the examination of the ash, is preferred. W. D. BIGELOW.

**Rice Oil.** BY C. A. BROWNE, JR. *The La. Planter*, **34**, June 3, 1905.—The author's attention was attracted by the evident distaste of farm animals for many lots of rice feeds. This was found to be due to a rapid development of acidity in the oil of the feeds. The development of acidity takes place only after the milling process and is due to the presence of a special ferment known as lipase, which, on the exposure of oil-bearing tissues to the air, causes a splitting up of the neutral glycerides into glycerol and fatty acids. In order to prevent the deterioration of rice feeds on standing he found it necessary either to kill the ferment by heat or to remove the oil. In connection with the study an examination of the oil was made and the following constants determined in two samples of oil:

| | I. | II. |
|---|---|---|
| Specific gravity[1] | 0.8907 | 0.9075 |
| Melting-point (point of liquefaction) | 24° | ...... |
| Acid number | 166.2 | 89.9 |
| Saponification number | 193.5 | 193.1 |
| Ether number | 27.3 | 103.2 |
| Iodine number | 91.65 | 100.35 |
| Reichert-Meissl number (volatile acids) | 1.1 | ...... |
| Mean molecular weight of insoluble fatty acids | 289.3 | ...... |
| Melting-point of insoluble fatty acids | 36° | ...... |

[1] Specific gravity (I) $\frac{99°}{99°}$ C; (II) 110° F.

Both of these samples were prepared from old lots of rice and were somewhat rancid, as is shown by the high acid number. The yield of glycerol as calculated from the ether number was found to vary from 1.49 per cent. for a very rancid oil to 10 per cent. for an oil from fresh rice bran. During the summer time (the temperature from 80° to 90° F.) the oil separates very readily into a solid and liquid portion, the solid portion constituting from 20 to 50 per cent. of the whole, according to the temperature of crystallization. It is suggested that in the utilization of the oil it will be found best to separate it into the solid and liquid portions, the former of which can probably be used to advantage in candle-making, and the latter in the manufacture of soaps. W. D. BIGELOW.

**Soil Temperatures, 1903-1904.** *Idaho Agr. Expt. Sta. Bull. 49.*—A weekly record of the temperature of the soil at various depths down to 6 feet. F. P. VEITCH.

**Soil Moisture Investigations for the Season, 1904.** *New Mexico Agr. Expt. Sta. Bull. 54.*—While irrigating oftener than once in three weeks after wheat begins to head increases the yield, the increase is scarcely economically obtained. The increase produced by using more than 24 inches of water was not economically obtained, and a difference of 6 inches in the amount of water applied is not indicated with certainty in the moisture content of the soil. There was no indication that the water percolated below the second foot. F. P. VEITCH.

**The Alkali Soils of Montana.** BY F. W. TRAPHAGEN. *Montana Agr. Expt. Sta. Bull. 54.*—The origin, nature and rise of alkali are discussed in a general way, while the remedies are discussed under prevention, amelioration and eradication, and it is stated that under-drainage is the remedy for the rise of alkali and should be adopted wherever possible. Pot experiments on the addition of salts to soil were conducted and it was found that magnesium sulphate up to 1 per cent. apparently had no ill effect on alfalfa. About 0.7 per cent. of sodium sulphate is about all that alfalfa will stand. With a mixture of two-thirds sodium sulphate and one-third magnesium sulphate the limiting quantity appears to be about the same as with sodium sulphate alone. Alkali analyses of a number of soils are also given.

F. P. VEITCH.

**An Apple Orchard Survey of Wayne Co., N. Y.** BY G. F. WARREN AND W. E. MCCOURT. *Cornell University Agr. Expt. Sta. Bull. 226.*—The bulletin contains, among other things, a brief general discussion of the fertilization of apple orchards and of the soil types of the county. F. P. VEITCH.

**The Sugar-cane Soils of Jamaica.** BY H. H. COUSINS. *Bull. Dept. Agr., Jamaica*, Vol. III, Pt. 7.—Analyses of a number of soils of the Upper Vere plain. The essential constituents soluble in hydrochloric acid, total humus and nitrogen, also potash and phosphoric acid soluble in 1 per cent. citric acid were determined. Carbonic acid present as carbonate was determined and mechanical analyses were made. From the data, recommendations as to the fertilizer treatment of the soils are made.

F. P. VEITCH.

**Experiments with Fertilizers on Tobacco.** BY CHAS. E. THORNE. *Ohio Agr. Expt. Sta. Bull. 161.*—These experiments, begun in 1903, were on gently rolling upland of the Miami valley derived from glacial drift consisting largely of weathered limestone gravel modified by admixtures of shales, sandstones and granites. The original forest growth was chiefly white oak and sugar maple.

In rotation experiments the average of two crops shows that the complete fertilizer containing the most nitrogen has produced not only the greatest yield but also the greatest net profit. Lime has been practically without marked effect on the yields. Sodium nitrate and ammonium sulphate have given nearly equal results, while tankage has given much lower results. So far manures have been less effective than fertilizers. In continuous culture experiments, the complete fertilizers have markedly increased the yield over the unfertilized plots. In the second year's crop phosphated manure gave approximately as good yields as the complete fertilizer and has yielded the greatest net profit.

F. P. VEITCH.

**Manures and Fertilizers Furnishing Nitrogen Compared.** BY WM. P. BROOKS. *17th Ann. Rep. Mass. Agr. Expt. Sta.*—A comparison of sodium nitrate, barn manure, dried blood and ammonium sulphate as sources of nitrogen on plots well supplied with potash and phosphoric acid shows, as the average of fifteen years' work with a number of different crops, that the value of the materials as nitrogen carriers is in the order given.

F. P. VEITCH.

**Report of the Chemist, Division of Fertilizers and Fertilizing Materials.** BY C. A. GOESSMAN. *17th Ann. Rep. Mass. Agr. Expt. Sta.*—A general summary of the fertilizer inspection work for 1904 and a list of the manufacturers and dealers who have secured certificates for the sale of fertilizers in the state, are given in Part I of the report.

Part II contains a summary of the miscellaneous materials analyzed, notes on wood-ashes, and lime-ashes and notes on phosphate slag and experiments with native phosphates. Under the last head experiments of heating raw phosphates with carnallite

and kieserite at 650° to 800° C. are mentioned, the product containing 15.23 per cent. of phosphoric acid soluble in 2 per cent. citric acid solution and 6.85 per cent. of potash. One part of apatite, fused with 4 parts of a mixture of sodium carbonate (23 parts) and potassium carbonate (39 parts) gave a product containing 3.68 per cent. of water-soluble and 26.78 per cent. of citrate-soluble phosphoric acid, and 1 part of apatite fused with the theoretical amount of mixed alkalies (1.15 parts) contained 2.56 per cent. water-soluble, 15.96 per cent. citrate-soluble and 12.70 per cent. insoluble phosphoric acid. Boiling apatite with carbonate solution gave negative results. F. P. VEITCH.

**Effect of a Legume upon the Following Crop.** BY WM. P. BROOKS. *17th Ann. Rep. Mass. Agr. Expt. Sta.*—In experiments conducted since 1890, in which different crops have been grown in the plowed down stubble of soy beans, no decided benefit has been observed to any of the crops. F. P. VEITCH.

**The Relative Value of Muriate and High Grade Sulphate of Potash.** BY WM. P. BROOKS. *17th Ann. Rep. Mass. Agr. Expt. Sta.*—In this experiment, begun in 1892 and conducted on the same land, all plots have received liberal applications of nitrogen and phosphates, to half of which potassium chloride and to the other half potassium sulphate was applied. Various crops have been grown and with but few exceptions the yields have been good. Potatoes, clovers, cabbages and soy beans have usually done best on the sulphate, while corn, grasses, oats, barley, vetches and sugar-beets have been equally good on the two salts. F. P. VEITCH.

**The Influence of Crop Rotations and Use of Farm Manure Upon the Humus Content and Fertility of Soils.** BY HARRY SNYDER. *Minn. Expt. Sta. Bull. 89.*—"When grains are grown continuously there is a heavy loss of nitrogen from the soil, caused by decay of the humus of which nitrogen is one of the component parts. When grains are grown in rotation with clover, and farm manures are applied to the corn crop the losses of nitrogen and humus are reduced to a minimum and the crop-producing power of the soil is increased." F. P. VEITCH.

**Fertilizers.** BY C. A. GOESSMAN. *Mass. Agr. Expt. Sta. Bull. 103.*—This bulletin contains analyses of manurial substances forwarded for examination, instructions regarding the sampling of material to be forwarded for analysis, instructions to manufacturers, importers, agents and sellers of commercial fertilizers and a discussion of the trade values of fertilizer ingredients for 1905. F. P. VEITCH.

**Liming the Soil.** BY CHAS. E. THORNE. *Ohio Agr. Expt. Sta. Bull. 159.*—The light sandy clay soils at the main station,

which have been under exhaustive cultivation for many years, have responded in a marked manner to lime which had been applied to a rotation of corn, oats, wheat and clover, all giving increased yields with a single application of lime equal to one ton per acre. There is no marked difference in the corn crop due to fertilizer on limed and unlimed land; there is some difference on wheat, while on clover the difference is marked in favor of the limed land.

As a whole, no combination of fertilizers, unless carrying nitrogen, has materially increased the yield of clover on unlimed land. Lime alone has nearly doubled the yield on unfertilized land and has more than doubled it where fertilizer containing no lime was used. Acid phosphate and potassium chloride, separately or together, have apparently injured clover. It is suggested that the superior yield obtained with sodium nitrate may be in part due to the neutralizing action of the residual soda. Lime applied directly to wheat has increased but little, if any, the immediately succeeding crop. Subsequent crops were helped. No material difference has been observed in the effect of quicklime and hydrated lime. On other lands liming has not been materially beneficial to the crops grown. F. P. VEITCH.

**Tabulated Analyses Showing the Amounts of Plant Food Constituents in Fruits, Vegetables, Etc.** BY L. L. VAN SLYKE, O. M. TAYLOR AND W. H. ANDREWS.—This article contains data showing the moisture, nitrogen, phosphoric acid and potash in the several portions of various fruits, vegetables, etc. F. P. VEITCH.

**Tabulated Analyses of Commercial Fertilizers, from January 1, 1904, to August 1, 1904.** *Pa. Dept. of Agr. Bull. 126.*—This bulletin contains a quite lengthy discussion of fertilizer valuations, tabulated analyses and list of licensed manufacturers and brands for the year 1904. F. P. VEITCH.

**Report of Analyses of Samples of Fertilizers.** Collected by the Commissioner of Agriculture during the summer and fall of 1904. *N. Y. Agr. Expt. Sta. Bull. 266.* F. P. VEITCH.

## PATENTS.

FEBRUARY 7, 1905.

781,689. George A. Stebbins, Watertown, N. Y. **Bisulphite apparatus.** Two tanks are provided with staggered horizontal partitions and stirrers, a device for refrigerating the gas, and connecting pipes with force pump.

781,711. Alden H. Brown, Boulder, Col. **Treating ores** bearing precious metals. The ore is pulverized in a cyanide

solution, it is sorted and leached by the same solution which is then separated and the residue concentrated. Tanks arranged step-wise are used.

781,714. John Campbell and Wm. A. Rushworth, Chicago, Ill. Assignors to Schoellkopf, Hanna and Co., Buffalo, N. Y. **Depilating composition.** Barium hydroxide 76, calcium hydroxide 18, and sodium sulphide 6, dissolved in 2100 parts water.

781,747. Frank A. Simonds, Grand Rapids, Mich. Assignor to Adoph Leitelt Iron Works, same place. **Calcining plaster.** The gypsum is calcined by steam heat in inclined retorts, passing from one to the other, the temperature carefully regulated to the proper point, about 300° F.

781,807. Franklin B. Carpenter, Denver, Colo. **Smelting copper ore.** Lime and iron pyrites are added before smelting.

781,808. As above for **reducing vanadium.** The furnace charge is made of a siliceous vanadium ore 100, iron oxide according to the vanadium present, dolomite 100, and fuel, an air blast is let on alloying the vanadium and iron, and uniting the dolomite and silica into a slag.

781,826. Henry W. Hemingway, Walthamstow, England. **Nitric acid.** A mixture of sodium nitrate, sulphuric acid and water is heated to 170° F. then ferrous sulphate is added by degrees, and the nitrous fumes thus generated are mixed with air and condensed.

781,836-7-8. Leon P. Lowe, San Francisco, Cal. All for **making gas.** Two checker-work chambers are used alternately, suitable connections being made, and in 781,837, condensers are attached to recover by-products.

781,867. Jonas W. Aylsworth, East Orange, N. J. Assignor to Edison Storage Battery Co., Orange, N. J. **Nickel-plating apparatus.** A continuous strip or a connected series of separate articles is passed through a bath and then into a heating chamber where they are heated to a welding temperature in a non-oxidizing atmosphere.

781,880-1-2-3-4. Joseph R. Hunter, Philadelphia, Pa. Assignor to Wm. Hinkle Smith, same place. Process of **treating bone, etc.** A cartilaginous material for rubber filler of fibers of ossein, or compressed ossein, are the subjects of these patents.

781,894. Arthur M. E. De Montureux, Paris, France. **Vulcanizing rubber to leather.** The flesh side of chrome leather is skived on the edges, degreased by benzine, and both it and the rubber tire are coated with a cement of rubber in carbon tetrachloride and sulphur chloride, and the surfaces are pressed together and vulcanized.

781,908. Wm. Richards, Mayburg, Pa. **Heating oil.** A tank of oil or a well is heated by an air heater, and the hot air

then run into a tank or down a shot hole where it is also heated by the hot air sent down.

781,926. H. W. Wiley, Washington, D. C. Assignor to International Smokeless Powder and Dynamite Co., Philadelphia, Pa. **Smokeless powder.** Nitrated cellulose having about 14 per cent. of nitrogen is dissolved in acetone, etc., and mixed with a 12 per cent. cellulose in ether-alcohol.

782,016. Simon Fabaron, Paris, France. Assignor to Pierre Leon Piot, same place. **Allylformaldehyde isosulphocyanate.** Formaldehyde is made to react on glycerol and allyl isosulphocyanate. The product is soluble in water, glycerol, aldehydes, acids, ammonia and mixtures thereof, and is used as a germicide. It boils at 200° C., is a light yellow fluid, darkening on exposure to light.

782,021. Halmar Freiberg, Charlottenburg, Germany. Assignor to Siemens and Halske, Aktiengesellschaft, Berlin. **Sterilizing water by ozone.** Finely divided streams of water are subjected to air and then to ozone under pressure.

782,056. John F. Richardson, Pittsburg, Pa. **Brazing metals.** A sheet of brass is placed between the metals to be joined and a flux and powdered brass added, the whole being fused together.

782,123-4. Oliver S. Garretson, Buffalo, N. Y. Assignor to Garretson Furnace Co., Pittsburg, Pa. **Converting matte.** First blowing the matte in a Bessemer converter or similar furnace then running the slag to a reverberatory fore-hearth, adding sulphur-bearing material and heating from above, producing a low-grade matte which is sent back to the Bessemer furnace. The blast from the converter is used on the reverberatory.

782,145. Louis M. LaFontaine, Paris, France. **Making copper.** The copper ores themselves are made anodes which are dissolved in an electrolyte of copper sulphate and sulphuric acid.

782,148. Anton P. Lepu, Greensburg, Kansas. **Artificial fuel.** Sodium chloride 200, sodium hydroxide 12, and 700 parts each of coal dust and earth.

782,154. Fritz Ach, deceased, by M. C. Massie, Administrator, Washington, D. C. Assignor to C. F. Boehringer Sohne, Mannheim Waldorf, Germany. **Theophyllin.** Chlorine is made to react on 8-chlorocaffeine, dissolving it in water by heat, concentrating to dryness and isolating the chlorotheophyllin.

FEBRUARY 14, 1905.

782,232. Benjamin F. Gardner, Chicago, Ill. Assignor to Charles K. Woolner and Sigmund Woolner of one-half. **Electric resistance.** Graphite 50, carborundum 25, sulphur 5, and India rubber 20 parts are mixed and vulcanized or carbonized.

782,252. Simeon D. Kudyson, Philadelphia, Pa. **Wood filler.** The impure colored residuum from the manufacture of acetic acid from lime acetate, ground in water, neutralized with calcium hydroxide and mixed in water, benzine or turpentine.

782,284. Frank F. Sommers, Jr., Saginaw, Mich. **Friction match.** Two coats are given the head of a splint, the first of high heating power and less readily ignitible, the second of less heating power and easily ignitible without noise, as phosphorus, zinc oxide and plaster.

782,308. Arthur Wright, Brighton, England. **Mercury electrolytic meter.** An inverted pear-shaped vessel has on one side an inverted retort-shaped bulb with a connecting pipe to the larger bulb that has a horizontal partition and a central boss of platinum gauze, the meshes being too small to pass mercury but large enough to pass the electrolyte.

782,316. John Battis and Alfred B. Goode, 11, Salem, Mass. **Preparing hair.** The fibers are coated with a suitable cement and dried, then laid parallel and pressed into strips like whalebone for which it is a substitute.

782,321. Wm. Brothers, Prestwich, England. **Gypsum filler.** Gypsum is boiled in water at 178° to 260° F. to form crystal hydrate, $2(CaSO_4).H_2O$, cooled and stirred to make hydrated crystals, $CaSO_4.2H_2O$, of very loose character which are separated and dried.

782,375. John W. Aylsworth, East Orange, N. J. Assignor to New Jersey Patent Co., Orange, N. J. **Compound for phonograph records.** Sodium stearate 100, aluminum stearate 20, carnauba wax 22, ceresin 22, and lampblack 2 parts. All but the soap and wax may be omitted.

782,401. Louis H. E. Lacroix, Pont de Cheruy, France. Assignor to Joseph L. Routin and Leon M. E. Mouraille, Lyons, France. **Alloy.** Lead 1000, antimony 15, sodium 1 part.

782,403. Clarence S. Lomax, Everett, Mass. **Purifying illuminating gas.** The gas is passed through and over a metallic oxide impregnated with sulphur and coated with aniline.

782,507. Josiah R. Kelly, Quincy, Ill. **Roofing cement.** Dry aluminum silicate 60, dry sand 25, ferrous carbonate 15 and oil enough to make plastic.

782,587. J. W. Vaughan, and Charles S. Horner, Eaton Rapids, Mich. **Preparing peat for fuel.** The water is first squeezed out and the partially dry peat is subjected to an electric current to liberate contained water that is separated mechanically.

782,609. George F. Jaubert, Paris, France. **Making oxygen.** Iron sulphate 15, calcium chloride 100 and copper sulphate 5 parts.

782,622. Rodolphe Quarez, Amiens, France. **Treating liquids with gases.** A large tank with conical bottom has a series of serrated disks arranged in the conical part, a heating pipe above the disks, a central downflow pipe provided with numerous conical deflectors, and supply pipes at the top by which liquids and gases are fed into this downflow column.

782,637. Karl Zimpell, Stettin, Germany. **Ammonium sulphate saturator.** A series of bells one over the other are placed in a secondary tank within a larger tank, and suitable connecting pipes.

782,679. George Merling, Frankfort-on-Main, and Robert Welde, Höchst-on-Main. Assignors to Meister, Lucius und Brüning, Höchst-on-Main, Germany. **Pseudocyclocitralidene acetone.** Trimethylcyclohexanecarboxylic acid is condensed and mixed with acetone or its homologues. A colorless oil soluble in alcohol, ether, benzine and ligroin, boiling at 133° to 135° C. under 8 mm. pressure and having a violet odor.

782,739. Emil Fischer, Berlin, Germany. Assignor to E. Merck, Darmstadt, Germany. **C-C-Dialkylbarbituric acid.** A new hypnotic, made by condensing diethylmalonic acid ester with urea, in the presence of a metal alcoholate, separating the sodium salt of diethylbarbituric acid by filtration, and adding acid. Recrystallized from water the acid melts at 191° C. and is soluble in alkaline hydroxides.

782,740. As above for **dipropylbarbituric acid.** Propyl compounds are substituted for ethyl in the above process. Melting-point 145° C.

782,741. As above, for a disubstituted **barbituric acid** in which there are two alcohol radicals, like methyl and ethyl or propyl.

782,742. As above for **trisubstituted barbituric acid** having three alcohol radicals as methyl, ethyl and propyl. Melts at 154.5.

782,782. Rudolf Knietsch and Maximilian Scharff, Ludwigshafen on Rhine, Germany. Assignors to Badische Anilin und Soda Fabrik, same place. **Revivifying contact substances.** After long use the contact material is brought in contact with dry roaster gases which contain a large amount of sulphurous acid.

FEBRUARY 21, 1905.

782,820. Jacob E. Bloom, New York, N. Y. **Edible fat.** A food product containing olein, palmitin and stearin with some free oleic acid in about the proportions in human fat.

782,821. As above, for the process of **preparing the fat compound.** Any animal or vegetable oils are selected whose mixture will make a compound having a composition analogous

to the composition attributed to human fat, and they are heated to $37^7/_9$° C. and well stirred together.

782,893. Charles E. Baker and Arthur W. Burwell, Cleveland, Ohio. **Treating alkali metal amalgam.** An alkali metal compound is electrolyzed with a cathode of mercury to make an amalgam, this is distilled with alkali hydride thereby obtaining mercury and an alkaline hydride, the mercury is condensed and returned and the alkali metal recovered.

782,894. As above for **reducing sulphides.** A broad electrolytic cell has an anode on the bottom, a perforated diaphragm above (which may be the anode) on which the metallic sulphide rests, the whole immersed in a molten chloride as lead chloride, which is decomposed by an electric current, the chlorine displacing the sulphur of the sulphide.

782,905. Richard Gley, Berlin, Germany. Assignor to Aktien Gesellschaft fur Anilin Fabrikation, same place. **Orange sulphur dye** Diformyl-*p*-phenylenediamine is mixed with *m*-toluylenediamine and heated with sulphur to 200° C. A yellow powder soluble in water and alcohol, dyeing with sodium sulphide and common salt clear orange color.

782,916. Wm. Maguire, Toronto, Canada. **Brick mixture.** Calcined magnesite, powdered glass and sand or glass equal parts, with water to render plastic.

782,922. Edgar F. Frick, Niagara Falls, N. Y. Assignor to Union Carbide Co., same place. **Calcium carbide.** Carbon and a calcium compound are made a resistance conductor between metal electrodes superposed, the lower electrode of iron partly melted, but the lower part of the electrode cooled, calcium carbide settles on the lower electrode and is removed and fresh charges supplied.

782,989. Hugh Rodman, Philadelphia, Pa. Assignor to Electric Storage Battery Co., all Philadelphia, Pa. **Making superoxide** in alkaline solution. Nickel superoxide is made by using a nickel anode in an attenuated alkaline solution, as caustic potash with 1 per cent. sodium perchlorate.

783,044. Joseph E. Johnson, Jr., Longdale, Va. **Smelting ores.** Ore and fuel are fed separately into a blast-furnace, the ore only being preheated by the products of combustion, whereby the waste gases are high in carbon dioxide and low in carbon monoxide and nitrogen.

783,045. As above for **separating oxygen.** Liquid air is heated to the boiling-point of nitrogen and the liquid rich in oxygen is separated by a centrifuge, drawing off the nitrogen from the inside and the oxygen from the outside of the centrifuge, and using the separated gases to cool more air.

783,054. Louis Le Goupil, Paris, France. **Hermetic joints.** Water 500, gelatin and sugar 100 each, thymol 2 parts, to coat metals or cement paper boxes, etc., a second coat is given of water 500, formalin 100, and potash alum 25 parts.

783,137. Robert Roe Jr., Amberg township, Marmette Co., Wis. Assignor to Robert Roe, East Providence, R. I. **Chemical paper pulp.** The digester is charged with the chips and the sulphite cooking liquor introduced of great strength at the bottom of the digester at ordinary temperature, then hot water is run in to dilute it, and heat up the mass.

783,150. Claus A. Spreckels and Charles A. Kern, New York, N. Y. Assignors to Federal Sugar Refining Co., Jersey City, N. J. **Sugar-cleaning compound.** Cotton-seed oil is treated with sulphuric acid to make a sulphonated derivative, the sulphonated oil is separated and mixed with kerosene.

783,176. George K. Cheney, New York, N. Y. Sound **record matrices.** To obtain a reverse metallic copy of a matrix, it is coated with a mixture of beeswax 15, carbon bisulphide 20, turpentine 18, asphaltum 1.5, and phosphorus 1.5 and electroplated on said coat.

783,288. Wm. S. Lamson, Lowell, Mass. **Compound for filling grooves in metal.** Carborundum 3, sand 4, magnesium chloride solution 3, and magnesium carbonate 2 parts.

783,332. Masimo Tomellini, Genoa, Italy. **Soldering aluminum.** Clean and fit the parts, coat with a powdered alloy of aluminum and tin, heat the joint, first to near the melting-point of aluminum, then apply a rod of a metal such as copper of higher melting-point than aluminum, and raise the temperature to the fusing-point of the metal.

783,367. George B. Craighill, Lynchburg, Va. **Making rosin.** The rosin is extracted from the cut wood by alcohol and the mixture fractionally distilled to separate alcohol, turpentine and rosin perfectly pure.

783,385. Wm. P. Rice, Chicago, Ill. **Charging liquids with gases.** (Soda water apparatus). A cylinder of compressed gas is placed along side of a charging column down which the water sprays against the gas, the charged water to be drawn off from the bottom of the column.

783,393. Gustave Tüschel, Odessa, Russia. **Making varnish.** Red accroide resin is boiled in water, the resin separated and dried, then melted with gum copal, mastic sandarach and turpentine, the mixture cooled on a marble slab, dissolved in methylated spirit and a little ether added.

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783,524. George W. Hooven, Englewood, N. J., and Samuel T. H. K. Endemann, Brooklyn, N. Y. Assignors to California

Products Co., Jersey City, N. J. Making **cream of tartar.** Pomace is treated with hot dilute oxalic acid, the liquor is concentrated and the pomace exhausted a second time, the weak second liquor being used as first liquor for a new batch. Potassium carbonate is added to the first liquor to make cream of tartar.

783,534. Albert L. Munson, New York, N. Y. **Artificial stone.** Sand 100, lime 10, cement 5, barium carbonate 1 and water molded and steamed. Tannic acid may be added.

783,570. Carlton Ellis, Boston, and Harry B. Chalmers, Dedham, Mass. **Treating lime.** Quicklime is slaked with a solution of alkaline earth acetates or sulphates to a dry pulverulent condition.

783,600. George H. Waterbury, Denver, Colo. Assignor to the Waterbury Metals Extraction Co., Spokane, Washington. **Extracting copper.** The pulverized ore is leached with dilute sulphurous acid containing a little sulphuric acid, the mixture is agitated by air and steam and the copper precipitated by aluminum or steel.

783,666. Burton E. Baker, Hartford, Conn. Assignor to himself, F. E. Harvey and Robert H. Lewis, same place. **Plate for static electric machines.** Layers of fibrous material as tough paper and shellac are compressed into a plate with a reinforced central portion.

783,675. George W. Briggs, Chicopee Falls, Mass. **Cores.** Linseed oil 10 (used in metal casting), soft soap 20, starch 25, and molasses 10, this mixture is added to core sand as required to mold it.

783,691. Otto F. Feix, Gloversville, N. Y. Making **castor leather.** The hide is first soaked in alkali, then tanned, grained while wet, again tanned and grained while dry, then finished.

783,710. Ebenezer W. Strain, Philadelphia, Pa. **Rubber compound.** Rosin distillate 80, china clay and linseed oil 10, and a rubber solution 10 per cent.

783,726. Franz von Kugelgen and George O. Seward, Holcombes Rock, Va. Assignors to the Willson Aluminum Co., New York, N. Y. **Detinning.** Tinned scrap is treated with dry liquid stannic chloride containing free chlorine.

783,783. Edward R. Hewitt, Garden City, New York, N. Y. Apparatus for **recovering volatile acids.** A vertical retort is surmounted by a column pipe with connecting pipe from the top to coil condenser, and beyond the condenser a heating tank, separating vessel, and trapped return flow to the retort, making a reflux apparatus with carefully regulated temperature.

783,797. Sheldon Norton, Watervliet, N. Y. **Fire-brick.** Molten blast-furnace slag is run in water, powdered, a little

hydraulic cement added, and the whole made into a paste with water, molded and sprinkled with water while setting.

783,810. Henry R. Woltman, Berkeley, Cal. **Artificial fuel.** Peat 50, petroleum 25, asphaltum 18, lime 2 and coke 5 parts.

783,828. Byron B. Goldsmith, New York, N. Y. **Patent leather.** Enameling coats of drying oil and pyroxylin are applied to the surface of sized leather.

783,844. James C. Mitchell, Reynolds, Ind. **Explosive.** Cane-sugar 30, milk-sugar 10, potassium chlorate 50, and an alcoholic extract of red sandal wood 10 parts.

783,872. John N. Leach, Melrose, Mass. Assignor to National Oil Heating Co., of Maine. **Gases from hydrocarbons.** Burner plates and mixing chambers are arranged so as to decompose oil and form permanent gases.

783,903. August Skoog, Shreveport, La. **Mercury furnace.** Zigzag baffle plates are arranged in a furnace inclosed by hollow walls, and containing small furnaces, and flues for circulating the products of combustion.

783,914. George Williams, Gary, Ill. **Plaster.** Dolomite is calcined and moistened with dilute sulphuric acid, then steamed under pressure and with some sodium silicate, to make plaster of Paris.

783,916. George von Wirkner, Schalke, Germany. **Making pitch.** Sulphuric acid is made to react on tar oils at 183° C., the acid is decomposed and the volatile parts distilled off till the pitch has the desired density. WILLIAM H. SEAMAN.

# REVIEW OF AMERICAN CHEMICAL RESEARCH.

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## GENERAL AND PHYSICAL CHEMISTRY.

**The Origin of Radium.** BY B. B. BOLTWOOD. *Phil. Mag.* [6], **9**, 599–613.—The amounts of radium emanation contained in uranium ores were determined by a method similar to that previously described (this Rev., **26**, 334, 442) but so improved as to yield much more accurate results. The emanation was liberated by treating the ore with acids. It was then transferred to an air-tight gold-leaf electroscope, by means of which its activity was determined. The amount of emanation spontaneously lost from the powdered ore before the treatment with acids was found by sealing a weighed quantity of the ore in a tube and determining the activity of the emanation which accumulated in the air space of the tube in the course of a known period of time, usually about four days, and calculating from these data the maximum amount of emanation thus lost. The total amount of emanation of a sample is the sum of the quantity so found and that liberated by acids. The uranium was determined by a modification of Brearley's method, the details being given in full. Twenty-one samples, with from 0.3 to 74.65 per cent. of uranium, were examined. The ratio of the activity of the emanation to the uranium content was found to be a good constant for all samples. This result is quite convincing confirmatory evidence of the truth of the hypothesis that radium is a decomposition product of uranium.

H. N. MCCOY.

**The Relative Proportion of Radium and Uranium in Radioactive Minerals.** BY E. RUTHERFORD AND B. B. BOLTWOOD. *Am. J. Sci.*, **20**, 55–56.—The ratio of radium to uranium in a mineral is a constant (preceding abstract). This ratio was determined by comparing the activity of the emanation produced by a standard quantity of pure radium bromide with that obtained from a sample of very pure uraninite containing a known weight

of uranium. It was found that one part of radium is in equilibrium with approximately $1.35 \times 10^6$ parts of uranium.

H. N. McCoy.

**The Production of Radium from Uranium.** By Frederick Soddy. *Phil. Mag.* [6], **9**, 770.—Many facts, known two years ago, seemed to indicate that radium is being continuously produced from some other form of matter. All evidence pointed toward uranium as the element whose disintegration gave rise to radium. The author began experiments in June, 1903, the object of which was to test this question directly. The radium present in 1 kilo of commercial uranium nitrate was removed by means of barium sulphate. The freshly prepared uranium solution yielded no radium emanation when air was blown through it. The solution was kept in a sealed vessel. Observations taken over a period of eighteen months indicated the gradual growth of radium in the solution. (Compare the author's two earlier papers: *Nature*, **70**, 30; **71**, 294). At the end of eighteen months the amount of emanation contained in the solution was over 100 times as great as at the end of the first week. The identity of the radium emanation was established by measurements of its rate of decay. The amount of radium corresponding to the quantity of emanation produced by the kilo of uranium in the course of 567 days was found, by comparison with the emanation from a known weight of radium, to be $1.6 \times 10^{-9}$ gram. This is but 0.001 of the quantity of radium calculated on the assumption of a direct change of U, through UX, into Ra. This result would seem to indicate one or more intermediate products, beside UX, of very slow rate of change as compared with the latter. The evidence, from other sources, in favor of this view is discussed.

H. N. McCoy.

**The Production of Radium from Uranium.** By B. B. Boltwood. *Am. J. Sci.*, **20**, 239–244.—The problem discussed in the preceding abstract has been studied by the author by the same general method as that employed by Soddy. The author first points out some apparent errors in the work of Soddy and then outlines a plan intended to avoid all probable errors. One hundred grams of uranium nitrate, freed from radium, were tested from time to time for radium emanation. It is necessary to boil the uranium solution for fifteen minutes to completely remove the radium emanation. The measurements were made with an electroscope reserved for this work and therefore not contaminated with radioactive substances from other sources. Its natural leak was small and remained constant during thirteen months use. It was capable of detecting, with certainty, the emanation from $1.7 \times 10^{-11}$ gram of radium. This amount is but $5 \times 10^{-7}$ of the equilibrium quantity corresponding to the amount of uranium used in the experiment. At no time from the beginning of the experiment to the end of a

period of 390 days was there obtained a detectable amount of radium emanation. The quantity of radium formed from 100 grams of uranium nitrate must have been less than $1.7 \times 10^{-11}$ grams. The amount is less than 0.0006 of the quantity expected from the disintegration hypothesis, on the supposition that Ra is formed from U with no intermediate product except UX. This amount, $1.7 \times 10^{-11}$ grams, is only about 0.1 of that estimated by Soddy to have been formed from an equal mass of uranium in eighteen months. Soddy's final conclusions are considered doubtful. It is highly probable that one or more products of slow rate of change intervene between uranium and radium.

H. N. McCoy.

**Slow Transformation Products of Radium.** By E. Rutherford. *Phil. Mag.* [6], **10**, 290–306.—Bodies exposed to radium emanation become covered with a highly radioactive deposit. The activity of this deposit is due chiefly to the products A, B and C. It decays rapidly, disappearing almost completely in the course of twenty-four hours. A very slight residual activity always remains on the plate. This residual activity increases with time, both $\alpha$- and $\beta$-rays being given out. Earlier work led to the conclusion that this residual activity was due to two products with slow rates of change as compared with those of A, B and C. It is now discovered that there are three instead of two slow transformation products. These are called D, E and F. The deposit from the radium emanation has, at the end of twenty-four hours, and therefore after the practically complete decay of A, B and C, very slight activity, due principally to $\beta$-rays. The $\beta$-ray activity increases at a rate which indicates its production at a constant rate and its decay according to the exponential equation. It reaches half its maximum value in six days. These phenomena are explained by supposing D, whose period of decay to half value had previously been found to be about forty years, to be a rayless, and therefore inactive product, whose disintegration produces E, which gives only $\beta$-rays and decays to half value in six days. The $\alpha$-ray activity, due to F, increases slowly and reaches a maximum in perhaps two or three years. These conclusions were confirmed by obtaining E and F separately and studying their properties. D and F are volatilized, but E is not, when a platinum plate, on which all three are deposited, is heated to 1000° for a few minutes. The activity of E, as so obtained, decays to half value in four and a half days, instead of six days as expected from the rate of formation of E from D. The author thinks this discrepancy is not due to experimental error, but seems to favor the remarkable view that the rate of decay of E has been changed by the high temperature to which it was subjected (see next abstract). The products D, E and F are all soluble in acids. Bismuth plates dipped in this solution become

highly active, giving some $\beta$-, but chiefly $\alpha$-rays. The $\beta$-ray activity soon disappears, showing that only F, together with a little E, has been deposited. The $\alpha$-ray activity, due to F, decays according to the exponential equation, falling to half value in 143 days. The author found that radio-tellurium has the same rate of decay. There is little doubt that these two bodies are identical, while polonium is probably a mixture of which F is the important $\alpha$-ray constituent. Evidence also strongly indicates that D is the essential constituent of radio-lead. From the rates of decay of F and of radium it is calculated that in a mineral the weight of F is but 0.00032 of that of the radium. A ton of 50 per cent. uranium ore contains 0.14 mg. of F. F is probably 3200 times as active as an equal weight of pure radium, at its minimum activity. H. N. McCoy.

**The Effect of High Temperatures on the Rate of Decay of the Active Deposit from Radium.** By H. L. Bronson. *Amer. J. Sci.*, **20**, 60–64.—Wires, charged negatively to 400 volts, were exposed for several hours to the radium emanation; they were then heated in an electric furnace, to known temperatures, between 700° and 1100°, for a few minutes. The time of decay of the activity to half value, $\theta$, varied between twenty-seven and nineteen minutes, and was apparently independent of the temperature to which the deposit had been heated. The value of $\theta$ increased with time after removal of the wire and deposit from the electric furnace. These results are in harmony with the view that the deposit, subsequent to the first half hour after removal from the emanation, consists of two products, radium B and radium C. B is rayless and decays to half value in twenty-six minutes; C gives rise to $\alpha$-, $\beta$- and $\gamma$-rays and decays to half value in nineteen minutes. B is volatile with heat while C is not. In accord with this explanation, it was found that when the wire is strongly heated in a sealed, hard glass tube $\theta$ does not fall below twenty-six minutes. H. N. McCoy.

**Heating Effect of the $\gamma$-Rays from Radium.** By E. Rutherford and H. T. Barnes. *Phil. Mag.* [6], **9**, 621–628.—Since the $\beta$- and $\gamma$-rays cause but 1 to 2 per cent. of the total ionization due to radium rays, it is probable that but a very small fraction of the heat evolved by radium is caused by the $\gamma$-rays. Paschen (*Phys. Z.*, **5**, 563 (1904)) had found, by the use of an ice calorimeter, the heat evolution of radium, surrounded by a sufficient thickness of lead to absorb all of the $\gamma$-rays, was more than twice as great as when only the $\alpha$-rays were absorbed. The authors have measured the heat evolution of 23.7 mg. of pure radium bromide by means of a differential air calorimeter, which was calibrated by means of an electrically heated coil of wire. The capsule containing the radium was placed, for the measurements, in cavities bored in lead or aluminium cylinders, 3 or 5 cm. high

and 3 cm. in diameter. The lead cylinders absorb 50 per cent. more of the $\gamma$-rays than the aluminium cylinders, but the heat evolution in the former was only 2 per cent. greater than in the latter. The values found were 108 and 106 gram-calories per hour for 1 gram of radium. The results of this investigation together with those given in a previous paper show that the heating effect of radium is largely due to the bombardment by the $\alpha$-particles expelled from its own mass. Paschen (*Phys. Z.*, **6**, 97 (1905)) has been unable to confirm his earlier conclusions and has found his ice-calorimeter method unsuitable to measure accurately such small quantities of heat. H. N. McCoy.

**The Properties of Radium in Minute Quantities.** By A. S. Eve, with a note by E. Rutherford. *Phil. Mag.* [6], **9**, 708–712.—It is shown that the activity of minute quantities of radium, between $10^{-4}$ and $10^{-7}$ mg., is very closely proportional to the mass of the radium. Some of the errors of the method of measurement of Volner (*Phys. Z.*, December 1, 1904), who arrived at an entirely different conclusion, are pointed out. Also, contrary to Volner, the authors find that the generally accepted view, that radium does not lose an appreciable amount of its activity in the course of a few months, is correct. H. N. McCoy.

**On the Chemical Separation of the Radioactive Components of Thorium Compounds.** By Richard B. Moore and Herman Schlundt. *Chem. News*, **91**, 259.—The authors find that, in addition to ammonia, the following reagents effect a separation of Th X from Th: pyridine, fumaric acid, aniline, potassium xanthogenate, hydrogen peroxide, ammonium fumarate, benzoic acid, and phenylhydrazine. It is possible, by the use of some of these reagents, to separate Th, as well as Th X, from one or more of the subsequent transformation products. H. N. McCoy.

**The Action of Radium Emanations on Minerals and Gems.** By Charles Baskerville and L. B. Lockhart. *Am. J. Sci.*, **20**, 95–96.—The action of radium emanation caused wollastonite, willemite, greenockite and tiffanyite to phosphoresce; several other minerals tested showed no phosphorescence. H. N. McCoy.

**The Phosphorescence of Zinc Sulphide through the Influence of Condensed Gases Obtained by Heating Rare-Earth Minerals.** By Charles Baskerville and L. B. Lockhart. *Am. J. Sci.*, **20**, 93–94.—Minerals containing thorium or uranium or both were heated and the gases evolved condensed in tubes containing screens of Sidot's blend. A long table is given showing qualitatively the degree of phosphorescence observed. Some experiments were made in the same way with pure uranium and thorium compounds. H. N. McCoy.

**On the Radioactive Properties of the Waters of the Springs**

**of the Hot Springs Reservation, Hot Springs, Ark.** BY B. B. BOLTWOOD. *Am. J. Sci.*, **20,** 128–132.—The gases obtained by boiling the waters of forty-four hot springs, temperatures 35° to 65° C., were all more or less radioactive. The activity is due to radium emanation, as shown by the decay to half value in three and nine-tenths days, while the activity of the deposit from the emanation fell to half value in twenty-eight minutes. The samples of water were examined six to ten days after collection and the initial activities were calculated by means of the equation $I_0 = Ie^{\lambda t}$. The initial quantity of emanation in one liter of water is given in terms of the amount of emanation associated with $10^{-4}$ grams of uranium in any ore of this element. On this basis the activity varied between 0.5 and 265.6. Duplicate samples collected at different times showed concordant results. The waters, as well as the deposited tufa, are practically free from radium. There seems to be no connection between the location of a spring or the temperature of its water and its activity. The waters of two cold springs, near by, were also highly radioactive.
H. N. MCCOY.

**The Education of Technical Chemists.** BY WILLIAM MCMURTRIE. *Chem. Eng.*, **2,** 142–143.—In this sixth article of the series with the above title (see this volume, R 321 and 443) the writer believes that preparation should begin at a very early age, with protection from educational fads, kindergarten methods, and useless repetition, and should be most thorough. Stress is laid on the importance of ancient languages and mathematics. Lengthening and broadening of the course in the professional school is called for as well as more exacting requirements. To be successful in manufacturing works demands more than the training of the general chemist. W. F. HILLEBRAND.

**The Testing Engineer.** BY C. B. DUDLEY. *Chem. Eng.*, **2,** 207–220.—Presidential address before the American Society for Testing Materials, Atlantic City, New Jersey, June 29, 1905. The gist of the address is that the engineer must be taught in the schools to think in order to meet sudden emergencies. Principles should be well grounded there. The real education comes later and is only to be acquired by incessant application and wide reading. Testing engineers are of three kinds: The unattached, the producer's, and the consumer's. Of these it is considered that the last named has the most attractive field of work because he has opportunity to study the behavior of materials in actual service, the ultimate criterion by which every industrial product must be judged. W. F. HILLEBRAND.

**The Course in Chemical Engineering at the University of Michigan.** BY ALFRED H. WHITE. *Chem. Eng.*, **2,** 262–264.—It is impossible to give in the limits at disposal details of the

course. Elective studies do not begin till the fourth year. The aim has been to give, besides the general foundation required of all engineers, enough chemistry on the one hand and mechanical engineering on the other to enable the graduate to understand chemical processes, and even act as his own chemist if need be, and to understand and operate machinery.

W. F. HILLEBRAND.

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## INORGANIC CHEMISTRY.

**Autocatalytic Decomposition of Silver Oxide.** BY GILBERT N. LEWIS. *Proc. Am. Acad. Arts and Sci.*, **40**, 719–733; *Z. phys. Chem.*, **52**, 310–326.—In the course of an investigation to determine the equilibrium pressure at a given temperature in the system

$$2Ag_2O \rightarrow 4Ag + O_2,$$

it was found that the velocity of decomposition at constant temperature increases as the reaction proceeds, passes through a maximum, and falls gradually to zero. Thus, 4.4 grams of a certain sample of silver oxide were heated in a thermostat to a temperature of 327.5°. For several hours the decomposition was not appreciable. After this time, the following values were observed:

| Time expired. Hours. | Number of minutes to yield 1 cc. of oxygen. |
|---|---|
| 10 | 60 |
| 13 | 27 |
| 14 | 18 |
| 16 | 4 |
| 18 | ½ |
| 20 | 1 |
| 21 | 3½ |

Before twenty-four hours had passed, the action was complete. Different samples of silver oxide give entirely different values; the purity and method of preparation have a great influence upon the rate of decomposition. The author found that this phenomenon is due to autocatalysis; the catalyzing agent is metallic silver. If metallic silver is mixed with silver oxide at the beginning of the experiment, the decomposition commences at once, and proceeds rapidly to completion. The catalytic influence increases with the amount of metallic silver added. Platinum and manganese dioxide were also found to act as catalyzers. The reaction possesses the general character of an explosion, slow enough to permit the velocity to be measured. But unlike most explosions, in this case the reaction proceeds at constant temperature, and is endothermic. The reaction proceeds with great regularity, and the curve of the reaction velocity approximates the curve of the equation $V = \frac{KE^{Kt}}{(1+E^{Kt})^2}$,

the equation of the simplest case of autocatalysis. With increase in temperature the maximum velocity is greater, and the whole time of decomposition is less. The author presents evidence in support of a theory which shall account for this and similar cases of autocatalysis. He assumed that the reaction whose velocity is measured in these experiments is $2O \rightleftarrows O_2$.

LAUDER W. JONES.

**On the Liberation of Hydrogen during the Action of Sodium upon Mercury.** BY L. KAHLENBERG AND HERMAN SCHLUNDT. *J. Phys. Chem.*, **9**, 257–260.—It was observed that the explosion which occurs when metallic sodium acts upon mercury, was caused by the liberation of hydrogen. To determine the volume of hydrogen which was evolved, bright pieces of sodium were introduced into pure dry mercury confined in a eudiometer tube. An average of a number of experiments showed that 1 gram of sodium caused the formation of 3.24 cc. of hydrogen, measured at 20° and 750 mm. In other words, when treated with mercury, ordinary sodium evolves somewhat more than three times its volume of hydrogen. Successive experiments with different samples of sodium showed that the volume of hydrogen varied but little. The purity of the hydrogen was established by the spectroscope. The authors suggest that the hydrogen may originate by the decomposition of sodium hydride which may be present in ordinary sodium. They call attention to some experiments made by Sir Norman Lockyer in 1879 in which he observed that distilled sodium, when heated in a vacuum, gave twenty times its volume of hydrogen. They point out that the question is quite worthy of further inquiry.

LAUDER W. JONES.

**Pure Nitrogen from Nitrous Oxide and Ammonia.** BY GEORGE P. BAXTER AND CHARLES H. HICKEY. *Am. Chem. J.*, **33**, 300.—Nitrogen, prepared from ammonium nitrite, requires subsequent purification to free it from oxygen and oxides of nitrogen. Nitrogen from air contains argon and other gases. To prepare pure nitrogen, the authors make use of the reactions which occur when nitrous or nitric oxide, mixed with ammonia, are subjected to high temperatures in the presence of some catalyzer. The following equations are given:

$$3N_2O + 2NH_3 = 4N_2 + 3H_2O,$$
$$6NO + 4NH_3 = 5N_2 + 6H_2O.$$

Nitric oxide, prepared in the usual way, was passed through a wash-bottle which contained strong ammonia water. This mixture of gases was then conducted through a red-hot tube of hard glass which contained two 4-inch spirals of copper gauze to serve as the catalyzer. The nitrogen formed in this way was found to be pure. A sufficiently long layer of platinized asbestos,

or iron turnings mixed with pieces of platinum, may be substituted for the spirals of copper gauze. It was found that the temperature must be kept high, and the ammonia water used must have a specific gravity above 0.92 in order to obtain pure nitrogen. When nitrous oxide was used, precautious were taken to avoid an explosion of the mixture of nitrous oxide and ammonia. Nitrous oxide, prepared by heating ammonium nitrate, was passed first through a short piece of hard glass tubing which contained platinized asbestos heated to dull redness. This caused a decomposition of the oxide. The mixture of nitrogen and oxygen was passed through ammonia water, and, finally, through a second hard glass tube with heated catalyzer. This yielded pure nitrogen. LAUDER W. JONES.

**Zinc Dust.** BY A. B. STEVENS. *Am. J. Pharm.*, **77**, 260–262.—Many samples of zinc dust tested by the author proved to contain nitrogen which could be evolved as ammonia by the action of sodium or potassium hydroxide. This was true even after the zinc dust had been shaken repeatedly with dilute hydrochloric acid. By means of ether, he succeeded in extracting from zinc dust a thick oil, like petroleum, which gave some ammonia with alkalies; the zinc, however, still contained nitrogen. Some experiments made, seem to indicate, as he thinks, that zinc dust has the power of fixing the nitrogen of the air.

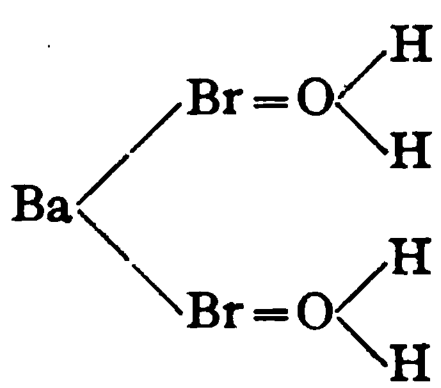
LAUDER W. JONES.

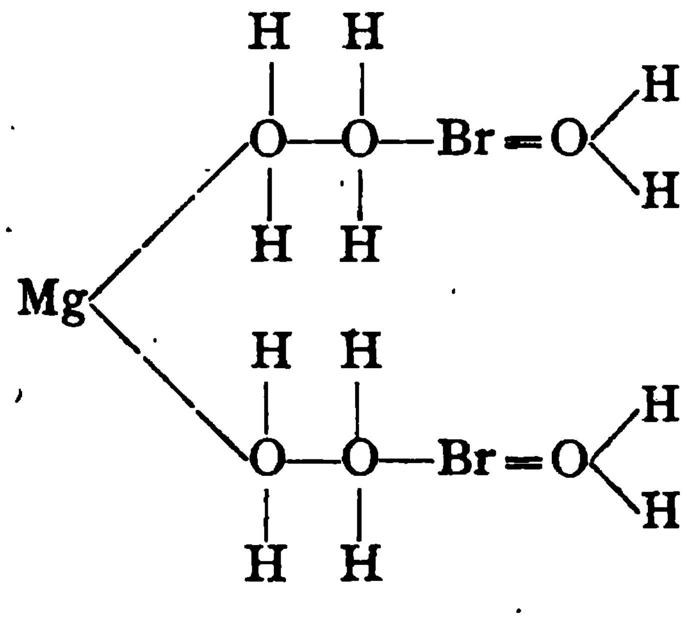
**Note on an Apparatus for Laboratory Blast and Suction.** BY PORTER W. SHIMER. *Chem. Eng.*, **1**, 376–378.—An apparatus is described which may be used in laboratories where there is no blast, and where the water supply is not sufficient for filtration purposes. It consists of an air pressure, or vacuum pump, in connection with two ordinary boilers, such as are commonly used in houses for hot water. An illustration is given.

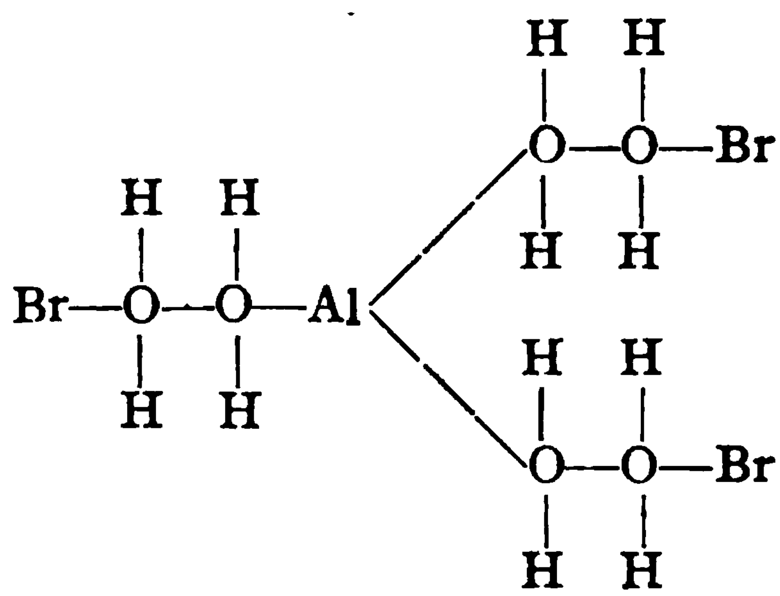
LAUDER W. JONES.

**The Behavior of Typical Hydrous Bromides when Heated in an Atmosphere of Hydrogen Bromide.** BY J. LEHN KREIDER. *Am. J. Sci.*, **20**, 97–106.—When heated in air, barium bromide ($BaBr_2,2H_2O$) gradually loses water between 70° and 160°, at which temperature dehydration is complete, without any appreciable loss of hydrobromic acid. With magnesium bromide ($MgBr_2,6H_2O$), at temperatures ranging from 70° to 240°, about one-third of the water may be removed without appreciable loss of hydrobromic acid. Thereafter, when the salt is heated in air, the loss of hydrobromic acid gradually increases as the temperature rises, and is inhibited by an atmosphere of hydrobromic acid. The same applies to the loss of water. From these facts, the author concludes that a third of the water in hydrous magnesium bromide bears a relation to the salt which differs from that

of the remaining molecules of water. Hydrous aluminum bromide ($AlBr_3,6H_2O$) at 100°, and higher temperatures, loses water and hydrobromic acid simultaneously, both in air and in an atmosphere of hydrobromic acid. Both loss of water and of hydrobromic acid are retarded by an atmosphere of hydrobromic acid. The author concludes that there is nothing to indicate that any part of the water in hydrous aluminum bromide possesses a different relation to the salt from that possessed by any other part. The following graphic formulae are based upon Cushman's hypothesis of inner and outer linking of the water molecules.







LAUDER W. JONES.

**Elucidation of the Thorium Problem.** BY CHARLES BASKERVILLE. *Ber.*, 38, 1444, and *Chem. News*, 91, 225.—The author comments upon the work of Meyer (*Ber.*, 38, 817). He urges all who wish to take up the investigation concerning the elementary nature of thorium, but insists that, in the repetition of his work, the exact conditions under which he worked should be maintained. LAUDER W. JONES.

**A Modification of Victor Meyer's Apparatus for the Determination of Vapor-Densities.** BY B. J. HARRINGTON. *Am. J. Sci.*, **20**, 225–229.—Two new forms of apparatus are described. In one form, the large cylindrical receptacle of the Victor Meyer apparatus is horizontal instead of vertical. At one end of the receptacle, there is a tube through which the substance is introduced. At the other end of the receptacle, the long stem of Victor Meyer's apparatus is replaced by a tube bent upon itself a number of times. Instead of the long, outer jacket, a metallic box is used as a bath. In the second form, the larger receptacle is placed vertical, instead of horizontal. The chief advantages seem to be compactness and ease in cleaning. Illustrations are given. LAUDER W. JONES.

**Examination of Incrustation Formed on Rable Plate of a McDougall Furnace.** BY WM. P. HEADDEN. *Proc. Colorado Sci. Soc.*, **8**, 39–44.—The specimen examined came from Anaconda, Montana. It formed layers of differing composition on the plate. The innermost layer approximated to ferrous sulphide carrying a little copper, after deducting considerable carbon, insoluble matter and some oxide. The middle layer held less oxide, carbon, etc., but much more copper, while the outermost approached cubanite, $CuFe_2S_4$, in composition.

W. F. HILLEBRAND.

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## MINERALOGICAL AND GEOLOGICAL CHEMISTRY.

**Economic Geology of the Bingham Mining District, Utah.** BY J. M. BOUTWELL, with A SECTION ON AREAL GEOLOGY, BY ARTHUR KEITH, AND AN INTRODUCTION ON GENERAL GEOLOGY, BY S. F. EMMONS. *U. S. Geol. Survey, Professional Paper No. 38*, 413 pp.; maps, plates.—The Bingham mining district is not only the oldest in the State of Utah but is now the greatest copper producer, in spite of the fact that its ores are of low grade. In this exhaustive report the matters of chief interest to the chemist relate to the nature, occurrence, genesis and alterations of the ores. The original mineralization, in connection with the intrusion of monzonitic magmas into the overlying sediments, produced first pyritous copper sulphides in limestone, and later, after the formation of extensive systems of fissures, heated solutions rising from the deeper unconsolidated magma effected a second mineralization during which gold, silver and lead were added besides more copper. "Since this second period of mineralization these original sulphide ores have been altered by surface waters, in their upper portions into carbonates and oxides, and relatively enriched in their underlying portions through replacement by black copper sulphides with additional

gold and silver, probably as tellurides." Besides a number of partial analyses there is a series of four by E. T. Allen, showing the chemical changes incident to the alteration of monzonitic walls of lodes. W. F. HILLEBRAND.

**The Structure and Genesis of the Comstock Lode.** BY JOHN A. REID. *Bull. Dept. Geol. Univ. of California, Vol. 4, No. 10,* pp. 177–199; figures.—This paper embodies some of the results of the author's studies of the famous Comstock lode. Since the appearance of the well-known treatises of earlier writers, underground developments have permitted of extending and, in some measure, correcting the conclusions then reached. The author has been led to believe that other deposits will be found, not only in greater depths to the east of the lode, but also to the west of Mt. Davidson. In a postscript this latter expectation is stated to have been realized in July, 1905. Two periods of ore deposition are recognized. The first accomplished the filling of primary fault-veins with low-grade material. In the second, new fissures, so-called rift veins, were opened and probably are still opening, in which the concentrated bonanzas were deposited. It is this second period which probably is continuing in depth at present, the mine waters, both deep and surface waters, being "solutions yielding very positive results to fire assay methods." A deep water from the 2250 foot level of the C. and C. shaft (temperature always over 116° F.) had the following composition in grams per liter (Prof. N. E. Wilson, Nevada University, analyst): $SiO_2$, 0.1334; $Al_2O_3$, 0.0025; $Fe_2O_3$, 0.0091; CaO, 0.1404; MgO, 0.0097; $SO_3$, 0.3957; Cl, 0.0190; $CO_2$, 0.0150; $K_2O$, 0.0643; $Na_2O$, 0.1765; total solids, 0.9656. The residue from evaporation of 10 liters of the water gave silver and gold in the proportion of 2.92 and 0.298 mg. respectively per ton of solution. The older surface ores are moving downward under the influence of acid surface waters, which in the Andes mine have covered walls and cross-cuts with from 6 inches to a foot of sulphates containing traces of gold and silver. In the Central tunnel, at a spot where those waters are not fully oxidized, ferrous sulphate and pyrite are being deposited together. The water is most acid where the pyrite is heaviest. As the wall is worked into, the acidity becomes less. Such a water from the Central tunnel gave Prof. Wilson in grams per liter: $SiO_2$, 0.6160; $Al_2O_3$, 18.2140; $Fe_2O_3$, 7.1786; $Mn_3O_4$, 1.2500; CaO, 1.7400; MgO, 10.8108; CuO, 0.1850; $SO_3$, 70.1154; Cl, 0.1276; $K_2O$, trace; $Na_2O$, 0.7209; total solids, 110.9583; free $H_2SO_4$, 125.0804. Silver and gold were present in the proportion of 188.0912 and 4.1528 mg. respectively per ton of solution. W. F. HILLEBRAND.

**Section of Mines [Canada], Annual Report for 1903.** *Geol. Survey of Canada,* 1903, *Part S,* 156 pp.—Statistics of the development and production of the mineral industries.

W. F. HILLEBRAND.

**The Clays and Clay Industries of Connecticut.** BY G. F. LOUGHLIN. *State of Connecticut State Geol. and Nat. Hist. Survey Bull., No. 4,* 121 pp.; map, plates.—The title sufficiently characterizes this work. Analyses are few. W. F. HILLEBRAND

**The Clays and Clay Industries of Indiana.** BY W. S. BLATCHLEY. *29th Ann. Rep. Dept. Geol. and Nat. Resources, Indiana,* pp. 13–657; maps, plates.—The title sufficiently characterizes this comprehensive work. Analyses are numerous.
W. F. HILLEBRAND.

**Mineral Production in Iowa in 1904.** BY S. W. BEYER. *Iowa Geol. Survey, Vol. 15, Ann. Rep., 1904,* pp. 15–32.
W. F. HILLEBRAND.

**Cement and Cement Materials of Iowa.** BY E. C. ECKEL AND H. F. BAIN. *Iowa Geol. Survey, Vol. 15, Ann. Rep., 1904,* pp. 33–124; plates. W. F. HILLEBRAND.

**Iowa Geological Survey, Vol. XV, 560 pp.**—In addition to the reports noticed in the two preceding abstracts this volume contains many detailed reports on the geology of separate counties of the state. In a few are to be found occasional analyses.
W. F. HILLEBRAND

**The Talc Deposits of Phillipsburg, New Jersey, and Easton, Pennsylvania.** BY F. B. PECK. *Geol. Survey of New Jersey, Ann. Rep. of the State Geologist for the Year 1904,* pp. 161–185; map, plates.—The manufacture and uses of mineral pulp are touched upon, and then the different quarries supplying the rocks and minerals out of which it is prepared are taken up in detail. Analyses frequently supplement the text.
W. F. HILLEBRAND.

**A Report upon Some Molding Sands of New Jersey.** BY H. B. KÜMMEL, assisted by S. H. HAMILTON. *Geol. Survey of New Jersey, Ann. Rep. of the State Geologist for the Year 1904,* pp. 187–246; figures.—The report contains the results of many mechanical analyses besides matter of a general character relating to the kinds and uses of molding sands. W. F. HILLEBRAND.

**The Mining Industry [New Jersey].** BY H. B. KÜMMEL. *Geol. Survey of New Jersey, Ann. Rep. of the State Geologist for the Year 1904,* pp. 291–302.—Appended to this brief account of the development of the iron and zinc mines of the state are tables of statistics of the production. W. F. HILLEBRAND.

**Description of the Mount Mitchell [North Carolina-Tennessee] Quadrangle.** BY ARTHUR KEITH.—Descriptive text accompanying the Mount Mitchell Folio No. 124 of the Geological Atlas issued by the U. S. Geol. Survey. Aside from the geological

features the important mineral resources of the region are described without analytical data. W. F. HILLEBRAND.

**The Production of Iron Ores in 1904.** BY JOHN BIRKINBINE. *U. S. Geol. Survey*, advance extract from *Mineral Resources of the U. S. Calendar Year 1904*, 37 pp.—Besides other statistical information the usual numerous cargo analyses of Lake Superior ores appear in this report. W. F. HILLEBRAND.

**The Production of Steel and Steel Hardening Metals, including Nickel and Cobalt, Chromium, Tungsten, Molybdenum, Vanadium, Titanium and Uranium, in 1904.** BY J. H. PRATT. *U. S. Geol. Survey*, advance extract from *Mineral Resources of the U. S. Calendar Year 1904*, 62 pp.—Aside from the usual statistical information, this report contains much of interest regarding the growing uses and manner of reduction of the metals named and their alloys. W. F. HILLEBRAND.

**Gems, Jeweler's Materials, and Ornamental Stones of California.** BY G. F. KUNZ. *California State Mining Bureau Bull., No. 37*, 171 pp.; numerous illustrations.—This is a readable account of the distribution, occurrences, associations, and properties of the numerous minerals covered by the title. Most space is devoted to those minerals for which southern California has in recent years become noted. W. F. HILLEBRAND.

**On the Genesis of Riebeckite and Riebeckite Rocks.** BY G. M. MURGOCI. *Am. J. Sci.*, **20**, 133–145.—After a brief resumé of the facts relating to the occurrence of riebeckite rocks in Dobrogea, Roumania, the author summarizes the observations which reveal the genesis of such rocks in general and especially those of Dobrogea. The chief factors in their formation are pressure and definite mineralizers. The latter, being unable to escape, continue to act on the magma and are gradually assimilated. With a change of one of the factors, especially the pressure, aegirite would appear with the riebeckite. Besides the chemical action there has been mechanical movement in the consolidating magma due to new upwellings of fluid matter, whereby, in connection with sinking of temperature, lowering of pressure and escape of mineralizers, variations of structure have been produced. "Riebeckite forms only in the relatively most acid magmas, and especially under the influence of mineralizers; its composition, content of fluorine, long period of crystallization from the beginning up to the end of, and even after the consolidation of, the magmas; its occurrence in cavities and its paragenesis with zircon, pyrochlore, fluorspar, sulphides, etc.; its presence as large crystals in pegmatites in immediate relation with veins of fluorspar or cryolite, and its absence in non-eruptive rocks, are many facts which support the view as to its origin presented in this paper. The mineralizers which aid to produce it are not

rich in water and sulphur vapors, but are characterized by an abundance of Zr, which has played a part in riebeckite granite similar to that of Sn in cassiterite granites. Zircon also forms throughout the whole period of consolidation. One can correlate; tourmaline, Sn; riebeckite, Zr; and katoforite (or another soda amphibole), Ti." W. F. HILLEBRAND.

**Purpurite, a New Mineral.** BY L. C. GRATON AND W. T. SCHALLER. *Am. J. Sci.*, **20**, 146–151.—The original mineral was discovered in the Faires tin mine at King's Mountain, Gaston County, North Carolina, and has since been found on material collected on Hiriart Hill, Pala, San Diego County, California, though not in sufficient amount for chemical examination. In both instances it is associated with lithia minerals, lithiophilite in the former, triphylite in the latter, of which it seems to be an alteration product by oxidation, hydration and removal of the alkali. The Carolina mineral "is found in small irregular masses in the tin-bearing pegmatite dikes, and in the near-by schist at the Faires mine. In most cases it occurs in narrow lenses or veinlets, and appears to have been deposited from solution in cavities. Occasionally, however, it is found in the midst of the pegmatite as if it were an original mineral." Crystallization probably orthorhombic, though possibly monoclinic. No specimens with crystal outline have been seen. Cleavage in one direction (pinacoidal?) rather perfect, much less so at right angles. Fracture, uneven. Brittle. Hardness, about 4 to 4.5. Specific gravity, approximately 3.15. Color, deep-red or reddish purple, whence the name (Latin *purpura*); sometimes with a slight bronzy iridescence and not uncommonly darker on the cleavage planes. Powder and streak decidedly purple or deep rose. Colors in transmitted light very beautiful. Pleochroism noticeable, deep scarlet inclining to rose-red parallel to the cleavage, across the cleavage beautiful purple. Refractive index, probably between 1.60 and 1.65. Double refraction high, probably not lower than 0.06, hence under crossed nicols the mineral appears to transmit as much and as brilliant light as without polarization. Both the Carolina and the California mineral are covered with a black or brownish black, pitchy material, containing the same chemical constituents as the purpurite itself and undoubtedly derived from it. The mineral fuses easily in a closed tube and gives off water, becoming yellowish brown. Readily soluble in hydrochloric acid, giving chlorine, while in nitric acid a black oxide of manganese separates. Composition (Schaller): $Fe_2O_3$, 15.89; $Mn_2O_3$, 29.25; $P_2O_5$, 47.30; $H_2O$, 5.26; CaO, 1.48; $Na_2O$, 0.84; $Li_2O$, trace; insoluble, 0.52; total, 100.54. All the water is given off at a low temperature, 3.31 per cent. of it at 105°; hence it is regarded as water of crystallization. Including the monoxide bases the ratios lead to a normal orthophosphate formula with

one molecule of water of crystallization, or $2\ R''' PO_4 + H_2O$. This is the first manganic phosphate noted in the literature.

W. F. HILLEBRAND.

**The Pegmatyte Veins of Pala, San Diego County [California].** BY G. A. WARING. *Am. Geologist*, **35**, 356–369; plates, figures. —This paper is devoid of new chemical matter, but contains interesting notes on the distribution and structure of the veins, their origin, the minerals occurring in them and their alterations.

W. F. HILLEBRAND.

**Estimation of Silica in the Bedford [Indiana] Limestone.** BY NICHOLAS KNIGHT. *Am. Geologist*, **36**, 57–60.—Over two pages are devoted to descriptions of the determination of a little over half a per cent. of silica by different methods and to prove that none of it is dissolved on treating the rock with hydrochloric acid.

W. F. HILLEBRAND.

**The Secondary Origin of Certain Granites.** BY R. A. DALY. *Am. J. Sci.*, **20**, 185–216; figures.—"The result of the investigation has been to confirm the writer's general theoretical conclusions on the subject of assimilation where it was necessarily introduced among the tests of the hypothesis of magmatic stoping. Assimilation and differentiation are not antagonistic processes; both of them are involved in the secondary origin of some granites."

W. F. HILLEBRAND.

**On Tychite, a New Mineral from Borax Lake, California, and on Its Artificial Production and Its Relations to Northupite.** BY S. L. PENFIELD AND G. S. JAMIESON. *Am. J. Sci.*, **20**, 217–224.—Among several thousand crystals of northupite, $MgCO_3$, $Na_2CO_3$, NaCl, there have been found since 1895 four crystals, likewise octahedral, and apparently differing chemically from northupite only in the presence of $SO_4$ in place of Cl. Artificial crystals of what is believed to be the same mineral have been prepared, following the method of de Schulten for northupite, by heating in a loosely stoppered flask 8 grams of $Na_2CO_3$ and 34 of $Na_2SO_4$ dissolved in 120 cc. of water to which 1.4 grams of $MgSO_4$ were then added. After five days, an abundant crop of small crystals began to form. Their composition agreed almost exactly with that required by theory, and the indices of refraction of a natural and an artificial crystal were found to be respectively 1.508 and 1.510. There is a theoretical discussion of the probable structure of the molecules of northupite and tychite. The isomorphism in them of such dissimilar constituents as Cl and $SO_4$ is attributed to the greater mass effect of the other atoms, alike in each case, an explanation earlier applied by Penfield to other minerals, as tourmaline and the alunite-

jarosite group. The name tychite (τυχή) is given to the new mineral in reference to its chance discovery.

W. F. HILLEBRAND.

**The Geology of Littleton, New Hampshire.** BY C. H. HITCHCOCK. Reprinted from History of Littleton. University Press, Cambridge, Mass., 32 pp. W. F. HILLEBRAND.

**Chemistry of Ore Deposits.** BY AGRICOLA. *Eng. Min. J.*, **79**, 1147.—Referring to a recent article the writer deprecates the use of purely hypothetical equations, quoting as an example $CuFeS_2 + CuSO_4 = 2CuS + FeSO_4$, and suggesting the desirability on various grounds of proving its correctness in some qualitative way. W. F. HILLEBRAND.

**The Geology of the Upper Region of the Main Walker River, Nevada.** BY DWIGHT T. SMITH. *Bull. Dept. Geol., University of California, Vol.* 4, *No. 1*, pp. 1–32; maps, plates, figures.—The region in question has not received special attention at the hands of any geologist. The names in sequence of age of the igneous rocks described in this paper are granite, granite-porphyry, porphyrite, hornblende-andesite, rhyolite, later andesite and basalt. Of these a granite porphyry and a rhyolite are represented by analyses. Copper and gold are the valuable metals in the ore deposits, but they are not associated with one another in paying values. An occurrence of native copper is noted in which the reduced condition has been traced to heat generated by dynamic action. W. F. HILLEBRAND.

**On Basic Substitutions in the Zeolites.** BY F. W. CLARKE. *Proc. Washington Acad. Sci.*, **7**, 257–266; *Z. anorg. Chem.*, **46**, 197–207.—This paper gives a resumé, with discussion, of the work of Messrs. George Steiger (see this Journal, **24**, R 449, and **27**, R 462) and H. C. McNeil (as yet unpublished). The latter prepared barium and strontium analcite by fusing the natural mineral with barium or strontium chloride and leaching, when the new compounds remained undissolved. By reason of the necessarily higher temperatures than were required for the production of the ammonium, silver and thallium zeolites of Mr. Steiger, some decomposition of the resulting compounds occurred, so that their analyses do not always conform closely with the theoretical formulas. Complete replacement of sodium by the alkaline-earth metal resulted, however. McNeil also prepared sodium stilbite, chabazite and thomsonite, though not in pure states, owing to the retention of Cl by the final products. This retention of Cl, and of $NO_3$ in some of Steiger's preparations, is discussed by the author. Of the two suggested possible explanations, mere retention of the flux or the formation of compounds analogous to sodalite and marialite, the latter is regarded as well worthy of consideration. W. F. HILLEBRAND.

**Third Annual Report of the Superintendent of the Bureau of Government Laboratories [Manila] for the Period from Sept. 1, 1903, to August 31, 1904,** 105 pp.—The portion devoted to the chemical laboratory contains a few data on tests of ores, coals, clays, limestones and the water supply of Manila. "The first platinum ever definitely identified in the Islands, so far as the records either of this or of the Mining Bureau show, was recently separated in the laboratory from some magnetic sand obtained from Rizal Province. In 5.96 grams of sand 15.88 mg. of platinum were found." W. F. HILLEBRAND.

**The Limestone-Granite Contact Deposits of Washington Camp, Arizona.** BY W. O. CROSBY. *Tech. Quart.*, **18,** 171–190. —Although this mining district, near the southern boundary of Arizona and about 20 miles east of Nogales, is little known and at present economically unimportant, its deposits are mineralogically and structurally "typical examples of ore bodies developed in connection with the garnet ledge now recognized as a normal feature of granite-limestone contacts....and capable of throwing important light upon the origin and genetic relations of the type." The author marshals much evidence in favor of the theory that in this and other like cases the materials for the minerals of the garnet ledge were originally altogether in the limestones traversed or surrounded by the igneous magma, and that the latter contributed to the metamorphism of the former merely heat and possibly some water. Where the limestones were pure the contact minerals fail, and the granite contact surface itself shows no change. Where the ores (at present chiefly chalcopyrite, sphalerite, and very subordinate galena) are "associated with garnet zones following the limestone-granite contact, the normal position of the ore......is clearly on the inner margin of the zone, facing the limestone and not the granite." For this and other reasons the conclusion is that, since the ores originally must have come from either the limestone or the granite, their source was in the former. "Washington Camp is undoubtedly an outlier, isolated by igneous intrusion and erosion, of the great series of Paleozoic limestones in which are found a very large proportion of the ore deposits of the Rocky Mountain region and the Pacific coast, as well as the wide-spread and rich zinc and lead deposits of the Mississippi Valley..............It appears difficult.....to find any warrant for doubting that this great limestone series, or some part of it, is normally and originally metalliferous, or thát, stimulated by intense and long-continued igneous and metamorphic agency (which was not required in the Mississippi Valley), the circulation of the normal ground water has proved equal to a more or less complete concentration of the metallic contents of the limestone." W. F. HILLEBRAND.

**Lead, Zinc, and Fluorspar Deposits of Western Kentucky.**

By E. O. Ulrich and W. S. Tangier Smith. *U. S. Geol. Survey, Professional Paper No. 36*, 218 pp.; maps, plates, figures.—Part I of this report, "Geology and General Relations," is by the first-named author; Part II, "Ore Deposits and Mines," is by the second named. The region under discussion adjoins a similar metalliferous area across the Ohio river in southern Illinois (see this Journal, **27**, R 456). Dr. Smith cites observations which "strongly suggest, though they do not prove, that the purplish fluorite, at least in western Kentucky, is derived from fluorite of other colors by oxidation of the contained coloring-matter." The ores occur in fissure veins, as cementing material of breccias, and as metasomatic replacements, the first of the three being most important. Fluorite, barite, and some galena and sphalerite constitute the deposits of the first and second types, while in the third type sphalerite predominates below the influence of surface oxidation, smithsonite within that zone. In Dr. Smith's opinion the source of the ores was rather limestone than a deep-seated intruded rock, as suggested by Dr. Bain for the deposits in southern Illinois. W. F. Hillebrand.

**The Copper Deposits of Missouri.** By H. Foster Bain and E. O. Ulrich. *U. S. Geol. Survey Bull., No. 267*, 52 pp.; plates, figures.—No very large deposits are known or likely to be found, but those discovered should be easily and cheaply mined.
W. F. Hillebrand.

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## ANALYTICAL CHEMISTRY.

**Testing Briquette Pitch.** By G. O. Binder. *Eng. Min. J.*, August 26, 1905.—Where a special press is not available for making briquettes for purposes of testing, a small "diamond mortar" is used, and the composition of pitch with coal, is compressed with several blows from a hammer. To compare different kinds of pitch, a uniform material such as sand or anthracite coal is used. Tests are made by exposing in the sun to see if the briquette will soften, and cooking in the fire to see whether it cakes or crumbles. S. P. Sadtler.

**Valuation of Tannic Acid from the Point of View of the Dyer and Calico Printer.** By Walter L. Williams. *J. Soc. Chem. Ind.*, August 31, 1905.—The tannin materials used by the dyer and calico printer are commercial tannic acid, sumac, catechu and gambier, the first two being the most important. Sumac should be tested for moisture, tannic acid, ash and adulteration. For the latter the microscopical method of Lamb (*J. Dyers and Colorists*, **15**, 60, and **20**, 265) is referred to; also one by Priestman (*J. Soc. Chem. Ind.*, **24**, 231). Sumac extract is also much used

and also more or less bleached forms called colorless extracts. Specific gravity figures are not truly comparable with the actual tannin contents. Dyeing tests are generally found to be the best. Catechu and gambier are used for the colors they contain rather than the tannin. Commercial tannic acid is generally obtained by extraction from gall-nuts, the least colored of these being the Japanese or Chinese galls. Tannin is extracted by means of ether, alcohol and water. That obtained with ether is fluffy and generally the purest. Acetone is also used as a solvent for extracting tannin. For the qualitative recognition of tannin materials, reference is made to the procedure of Procter (*J. Soc. Chem. Ind.*, **13**, 187). Besides gallotannic acid, the commercial article contains varying amounts of glucose, chlorophyll, volatile oil, resins, ellagic and gallic acids and moisture. Starch and dextrin may be present as wilful adulterants. The gallotannic acid is generally 70 to 90 per cent., but may fall to 50 per cent. Sampling is very important. "Tryers" are run down the barrels one-third way from the circumference. The moisture is best determined in vacuum desiccators. Large amounts of resinous or tarry matters are very objectionable and can be detected by boiling up with an equal weight of acetic acid and setting aside to cool. A thick, sticky mass collects at the top. Various methods of tannin assay are reviewed, the hide-powder method, titrations with basic aniline dyes, tartar emetic. The author, however, prefers the permanganate process as described (*J. Soc. Chem. Ind.*, **4**, 263). For quick results a printing-dye test with a small printing roller is used. Tannic acid is precipitated with tartar emetic in a paste made with British gum as a thickener. With gallic acid alone, no trace of the dye-stuff is found on the fibers, while the color is deeper the larger the percentage of tannin.

S. P. SADTLER.

**Preparation of Volumetric Solutions.** BY E. C. WORDEN AND JOHN MOTION. *J. Soc. Chem. Ind.*, **24**, 178.—As the result of a careful theoretical and experimental study of the various methods proposed for the standardization of solutions of the acids commonly used in volumetric analysis, the authors conclude that the most accurate and most easily performed method is that of taking the specific gravity of the acids in carefully calibrated pycnometers. In order that this method may be made available for analysts the authors have made a large number of analytical and specific gravity determinations in which great care was taken to guard against errors. Tables are given for a temperature of 60° F. for sulphuric acid solutions of sp. gr. 1.000 to sp. gr. 1.420; for hydrochloric acid solutions of sp. gr. 1.000 to sp. gr. 1.029; and for oxalic acid solutions of sp. gr. 1.000 to sp. gr. 1.025.

E. M. CHAMOT.

**Analyses of Senna.** BY RUSSELL W. MOORE. *J. Soc. Chem.*

*Ind.*, **24**, 487.—The author finds that the determination of soluble matter is best made by boiling 10 grams of the sample with water—in a liter flask, the contents made up to the mark and 200 cc. filtered and evaporated to dryness on the water-bath. The residue is then dried to constant weight in a steam oven. The average of six samples examined gave 37.06 per cent. water-soluble extract. E. M. CHAMOT.

**Action of Phosphates on Platinum when Heated with It in the Presence of Carbon.** BY WM. P. HEADDEN. *Proc. Colorado Sci. Soc.*, **8**, 45–49.—The deterioration of platinum crucibles often used for the ignition of ammonio-magnesian phosphate led the author to make experiments which he describes. Phosphates were reduced by heating platinum in contact with them and carbon, and fusible alloys were obtained, differing, however, in behavior from the diphosphide, the only phosphide of which he could find mention. Analysis showed the presence of 2.3 per cent. of phosphorus. The material is very difficultly soluble in aqua regia, the diphosphide being soluble. The author offers no evidence that his products are other than solutions of a phosphide in platinum. W. F. HILLEBRAND.

**Some Reactions Due to Iridium.** BY WM. P. HEADDEN. *Proc. Colorado Sci. Soc.*, **8**, 50–53.—Certain reactions obtained with solutions of the alloys described in the preceding abstract are attributed to iridium. W. F. HILLEBRAND.

## BIOLOGICAL CHEMISTRY.

**On the Relationship between the Rate of Growth, Age, and Potassium and Calcium Content of Mouse Tumors (Adeno-Carcinoma, Jensen).** BY G. H. A. CLOWES AND W. S. FRISBIE. *Am. J. Physiol.*, **14**, 173–193.—In the present paper it is shown that rapidly growing, large tumors in mice contain a high percentage of potassium and little or no calcium: also that old, slowly growing, relatively necrotic tumors contain large amounts of calcium and little or no potassium. It has been observed that in groups of comparable mice the potassium and calcium content is a function of the age and rapidity of development of the tumor, discrepancies observed being frequently attributable to more rapid growth or degenerative processes. Certain groups appear to possess, at given ages, relatively larger proportions of potassium and others relatively larger proportions of calcium; but the largest yield of tumors and the most rapid growth as represented by the unit of tumor produced per unit of mice in the unit of time, is apparently associated with an equilibrium in which both elements are present, the ratio averaging from 2:1 to 3:2 in favor of potassium. F. P. UNDERHILL.

**The Nature of Chemical and Electrical Stimulation. II. The Tension Coefficient of Salts and the Precipitation of Colloids by Electrolytes.** By A. P. Mathews. *Am. J. Physiol.*, 14, 203–231.—The precipitation of colloidal egg-albumin, and possibly other colloids, is brought about chiefly by an alteration in the surface energy of the colloid. The precipitating power of an electrolyte is determined primarily by the solution tensions of the ions. The ion of opposite sign to the colloid precipitates, the ion of the same sign dissolves the colloid, and is not inert, as is often stated. The action of any electrolyte, whether dissolving or precipitating, upon colloidal albumin, is determined by the fact that the anion or the cation predominates in its action. The oxidizing or reducing powers of any salt, and their precipitating or dissolving powers, and their toxic action on protoplasm are determined by the formula

$$\pi = \frac{\epsilon_a - \epsilon_c}{\epsilon_a + \epsilon_c}.$$

In this formula $\epsilon_a$ and $\epsilon_c$ are the solution tensions respectively of anion and cation in the given concentration. The factor $\pi$ is called the tension coefficient of the salt. If $\pi$ of the salt is greater, that is, more positive, than $\pi$ of the colloid, when the colloid is electro-negative, the salt will precipitate the colloid; if it is less than $\pi$ colloid, the salt dissolves the colloid. The difference in precipitating power of salts having ions of the same valence is measured by the difference between their tension coefficients and that of the colloid. The valence of the ion of the same sign as the colloid is without importance in determining the action of the ion; the valence of the ion of the opposite sign to the colloid is of importance. If the valence is greater than unity, the effect of polyvalence is to increase the precipitating power of the salt. The ion acts as if its solution tension was lower than it is. It is possible that a correction can be made to the foregoing formula by substituting $\epsilon_c$—A ($n$—1) in place of $\epsilon_c$ in the numerator of the tension coefficient. In this expression $\epsilon_c$ is the solution tension of the ion of opposite sign to the colloid; A is some positive number; and $n$ the valence of the ion. The results of this investigation do not permit a calculation of A. As the valence of the ion of the same sign as the colloid is without importance, and as this ion has an opposite action to the precipitating ion, it appears that Whetham's explanation of the importance of valence is incorrect. It is suggested that the valence of the polyvalent precipitating ion is of importance because such an ion is able to combine with several colloidal particles forming larger aggregations than a univalent salt of the same tension coefficient. Valence influences flocking, according to this explanation, by influencing the mass and not the surface energy of the colloidal particles. The hydrolytic dissociation of the salts of the heavy metals is an important factor in their

action. For salts having precipitating ions of the same valence, the concentration of the ions of the salt necessary to precipitate a given amount of colloid multiplied by the tension coefficient may be expected to give a constant. This was found to be approximately true. F. P. UNDERHILL.

**Observations on the Fate of Oil Injected Subcutaneously.** BY YANDELL HENDERSON AND EDWARD FRANCIS CROFUTT. *Am. J. Physiol.*, 14, 193–203.—Oil injected subcutaneously is readily and widely distributed through the subcutaneous spaces. Such oil is not, however, transformed *in situ* into adipose tissue. In fact, the tissues react to its presence as to any non-irritating foreign substance. In the blood, lymph, and milk it does not appear in detectable amounts. While the oil is ultimately absorbed and utilized in metabolism the process is one of extreme slowness. Oil injections in any moderate amount are, therefore, practically without nutritive value

F. P. UNDERHILL.

**The Chemistry of Malignant Growths. IV. The Pentose Content of Tumors.** BY S. P. BEEBE AND PHILIP SHAFFER. *Am. J. Physiol.*, 14, 231–239.—The pentose content of tumors from various sources has been determined, but owing to widely divergent results obtained, no conclusion has been drawn as to the significance of the content of pentose in tumors.

F. P. UNDERHILL.

**The Effect of Hypnotics and Antipyretics on the Rate of Catalysis of Hydrogen Peroxide by Kidney Extract.** BY C. HUGH NEILSON AND OLIVER P. TERRY. *Am. J. Physiol.*, 14, 248–252.—From these results it is seen that the general effect of the hypnotics is to retard the rate of catalysis. The degree of their retarding action is as follows: Chlorotone, chloralamide, chloral hydrate, bromidia, croton chloral, paraldehyde, urethane, hedonal. These hypnotics, when used as therapeutic agents, have approximately the following order: Chlorotone, chloralamide and chloral hydrate, croton chloral and the rest have about the same degree of fervor. Antipyrine has a stimulating effect on the rate of catalysis. F. P. UNDERHILL.

**On the Paths of Absorption from the Liver.** BY LAFAYETTE B. MENDEL AND FRANK P. UNDERHILL. *Am. J. Physiol.*, 14, 252–259.—The data presented indicate plainly that the hepatic blood capillaries form no exception to those found elsewhere in the body in their permeability to substances which find their way into the perivascular lymph spaces. The experiments do not offer any indication of a predominating rôle of the lymph channels in carrying away the morbid materials. It is not impossible that foreign substances found tardily in the lymph of the thoracic

duct are at times derived indirectly by a subsequent transference from the blood vessels, and thus have a twofold source.

F. P. UNDERHILL.

**On the Utilization of Various Carbohydrates without Intervention of the Alimentary Digestive Processes.** BY LAFAYETTE B. MENDEL AND PHILIP H. MITCHELL. *Am. J. Physiol.*, 14, 239–248.—In this paper various carbohydrates have been injected parenterally. The results were as follows:

| Substance injected. | Kind of injection. | Animal. | Quantity used. Grams. | Quantity recovered. Grams. | Quantity recovered. Per cent. |
|---|---|---|---|---|---|
| Glycogen. | Subcutaneous. | Rabbit. | 2.1–2.4 | 0.11–0.3 | 5–12 |
| " | " | Cat. | 1.74 | 0.32 | 18 |
| " | Intraperitoneal. | Bitch. | 2.8 | 0.09 | 3 |
| " | " | Rabbit. | 2.16–4.0 | 0.26–0.68 | 12–17 |
| Dextrins. | Subcutaneous. | " | 2.0 | 0.22 | 11 |
| " | " | Cat. | 2.0 | 0.45 | 22 |
| Soluble starch. | Intraperitoneal. | Bitch. | 6.4 | 0.43 | 7 |
| " " | " | Rabbit. | 2.5 | 0.76 | 30 |
| Inulin. | " | " | 2.2–2.8 | 1.43–2.2 | 65–78 |
| Isolichenin. | " | " | 1.76 | 0.2 | 11 |
| " | " | Bitch. | 0.8–1.5 | 0.17–0.64 | 21–42 |
| Saccharose. | " | " | 3.0 | 1.5 | 50 |
| Ovomucoid. | Subcutaneous. | Rabbit. | 1.4 | No sugar. | ... |

The experiments have failed to indicate any profound difference between glycogen and dextrin in their parenteral introduction into animals (see Mayer: *Fortschritte der Medicin*, 21, 417 (1903)). Renewed evidence is afforded of the importance of the alimentary digestive changes in the metabolism of carbohydrates.

F. P. UNDERHILL.

**A Study of the Proteins of the Castor Bean, with Special Reference to the Isolation of Ricin.** BY THOMAS B. OSBORNE, LAFAYETTE B. MENDEL AND ISAAC F. HARRIS. *Am. J. Physiol.*, 14, 259–287.—The chemical study of the castor bean indicates that it contains proteins of the same character as the other oil-seed which have been examined: namely, (1) a considerable quantity of a crystallizable globulin, (2) a much smaller amount of a coagulable albumin, and (3) proteoses. The elementary composition and reactions of these substances have been ascertained. The physiological properties—marked toxicity and agglutination of blood corpuscles—ascribed to the substance known as ricin are associated with the coagulable albumin of the castor bean. This protein was isolated in a state of considerable purity without impairment of its solubility or physiological action, and an improved method for the separation of ricin is thus introduced. The ricin preparations retain a considerably higher toxic power than those heretofore described, a limit of 0.001 mg. per kilo being exceeded as a fatal dose in rabbits. The toxic symptoms and the gross pathological conditions have been

compared with those of previous investigators. The behavior of various species of animals toward the ricin albumin has been studied, and the susceptibility of frogs found to be greatly increased when they are subjected to a warm environment (above 25° C.). The activity of the new preparations in agglutinating mammalian blood corpuscles is likewise very great, 0.001 per cent. sufficing in some instances to sediment dilute blood suspensions. This power is not destroyed by heat below the coagulation temperature of the albumin. The effect of trypsin on the active albumin (ricin) has been studied; the characteristic physiological properties are greatly impaired or destroyed by vigorous pancreatic digestion. A "purification" of ricin by such a method has failed. The evidence respecting the protein nature of ricin has been discussed. The present investigation affords no satisfactory reason for denying the identity of ricin with the coagulable albumin of the seed. F. P. UNDERHILL.

**The Mass-Movements of the Circulation as Shown by a Recoil Curve.** BY GANDELL HENDERSON. *Am. J. Physiol.*, **14**, 287–299.—In this paper it is shown that under the influence of the mass-movements of the circulation, the body recoils at each heart beat feetward, headward, and again feetward. By means of a "swinging table" these movements can be magnified one hundred times and recorded in the form of a "recoil curve." The amplitude of these recoil movements of the body is held to be proportional to the volume of the systolic discharge of the heart.

F. P. UNDERHILL.

**Freedom from Uric Acid and How to Obtain It.** BY ALEXANDER HAIG. *Med. Record*, **68**, 332–336.—The greatest freedom from uric acid is obtained by introducing none, and by passing out each day regularly and punctually, all that is formed in the body, and this regularity of excretion may be obtained by clothing warmly, by avoiding exposure to cold in every form, by eating freely of potatoes (especially in cold weather), by avoiding fruits that are out of season, and indeed by never taking fruit to any large extent, except in very warm weather. It is also advisable to secure the proper distribution of time between bodily and mental exertion, and dispense with dependence upon tonics, stimulants, and bracing climates. The result will be a better balance of mind and body, and a more healthy, natural and useful existence than has been generally experienced either by ourselves or by our ancestors in the previous century

F. P. UNDERHILL.

**A Scientific Classification of the Methods of Modifying Cow's Milk for Infant Feeding.** BY GODFREY ROGER PISEK. *Med. Record*, **68**, 408–413.—A discussion of all the methods employed in transforming cow's milk to meet the needs of the infant

F. P UNDERHILL.

**The Relation between Climate and Health, with Special Reference to American Occupation of the Philippine Islands.** By William S. Washburn. *Am. J. Med. Sci.*, **130**, 497–518.—With respect to the principal climatological factors, temperature, humidity, and atmospheric movements, the climate of the Philippine Archipelago is not extreme, as it is distinctly insular in character, the greater portion of the land area being not far distant from the ocean. There are other modifying influences which obtain in portions of the archipelago, such as general oceanic and local inter-island currents, prevailing winds, elevation, the state of cultivation and drainage of the soil, and the presence of forests and other plant life. Excluding localities in the tropics characterized by excessive heat, high relative humidity or unhealthful soil conditions, acclimation or physiological adaptation of the white man to tropical environment is possible—hence colonization is possible. Failures of the white race to live in the tropics and maintain health, excluding localities indicated above, appear to have been due principally to the non-observance of the rules of personal, domestic and public hygiene. As a rule, Americans appear to become acclimated in the Philippines during the third year of residence. With sanitary surroundings and by observing the rules of personal and domestic hygiene, residence of Americans in the Philippine Islands appears to be attended with as little danger of disease and death as residence in the United States under similar sanitary conditions.

F. P. Underhill.

**Clinical Investigations of the Digestion in the Insane: A Contribution to the Study of the Neuroses of the Stomach, with Special Reference to Hyperacidity and Bits of Mucosa Found in the Stomach Washings.** By David Murray Cowie and Florence Allen Inch. *Am. J. Med. Sci.*, **130**, 460–492.—In states of mental depression (melancholia) hyperacidity is the rule, occurring in 71.4 per cent. of von Noorden's 14 cases, 81.8 per cent. of the present 22 cases, or in 77.7 per cent. of all cases (36 in number). Males and females are equally affected. This hyperacidity is due to a true hyperchlorhydria. Hypertotal acidity also occurred in these cases, and in this respect they correspond with those reported by von Noorden. The hyperchlorhydria is of moderate degree, is fairly constant, and is associated with increased peptic power and rapid evacuation. The increased ecretion is due to the neurosis or psychosis and not to proliferative changes in the glands, as is evidenced by the presence of increased secretion associated with degenerative changes in the glandular elements, and of the entire mucosa. The evacuation of the stomach is usually normal or somewhat hastened after the Ewald test breakfast, while after the large stimulus of the Riegel meal and ordinary Asylum meal it is more frequently

hastened. In the cases showing hyperchlorhydria, the peptic value is never below normal and is frequently increased. Many of the insane are suffering from various forms of gastro-intestinal disease, and if proper treatment is instituted it is probable that the mental symptoms in these cases will proportionately decrease.

F. P. UNDERHILL.

**Concerning the Causes of Gallstones.** BY EDWIN BEER. *Am. J. Med. Sci.*, **130**, 432–435.—Beer shows that Naunyn factors—stagnation of bile plus inflammation of the bile—passage mucosa—do not seem sufficient by themselves to lead to gall-stone formation, even though the time allowed for the working of the causes be adequate. His own experiments also show that these two factors lead to stone formation in patients who previously had gall-stones. Here is found the first real evidence of the factors underlying gall-stone production and the causes of cholelithiasis in human beings. F. P. UNDERHILL.

**Enzymes in Tumors (Second Communication).** BY B. H. BUXTON AND PHILIP SHAFFER. *J. Med. Research*, **13** (New Series 8), 543–554.—The paper shows that both normal and embryoid tissues contain intracellula- enzymes which are practically similar to those found in tumors. There are great differences in the amount of the enzymes, but a comparison of results from normal and tumor tissues does not seem to lead to any particular conclusion. F. P. UNDERHILL.

## INDUSTRIAL CHEMISTRY.

**Notes on Nernst Filaments.** BY C. I. ZIMMERMAN. *Trans. Am. Electrochem. Soc.*, **7**, 79.—The phenomena observed by the author in the Nernst filaments are:

(1) Evidences of electrolysis which are chiefly noticed at current densities below normal. For this reason the direct current lamps have a short life at low temperatures.

(2) Liberation of heat at the anode and absorption at the cathode. These effects are so marked that an anode of platinum (melting-point 1,710° C.) may be melted, while a cathode of silver (melting-point 960° C.) remains solid.

(3) The cathode metal is absorbed by, or possibly projected into, the glower material towards the anode. This differs from the electrolytic effect already noted.

(4) Close to the cathode of direct current glowers a constricted portion is observed after a time, which does not seem to be an electrolytic effect.

(5) The air in the neighborhood of the glower is conductive (ionized). This effect is more marked as the temperature in-

creases. With alternating currents there is a cumulative static charge observable, and with a 200 volt alternating current glower a deflection of 50 volts is noticeable in a direct current voltmeter connected with the "exploring" wire with which the ionizing effect is observed. S. P. SADTLER.

**Changes which Take Place in the Clinkering of the Lehigh Valley "Cement Rock."** BY RICHARD K. MEADE. *Chem. Eng.*, August, 1905.—This investigation deals mainly with the possible contamination of the clinker with the ashes of the coal used and the losses of alkalies. Duplicate analyses were made of the raw material entering the kilns every three minutes for an entire afternoon, and after a lapse of forty-five minutes, to allow the charge time to come through the kiln, analyses were made of the clinker every three minutes.

In experiments "A" and "B" limestone was added to the argillaceous limestone and in "C," slate.

EXPERIMENT A.

| | Raw material calculated to a clinker. | Clinker calculated without its $H_2O$, $CO_2$, etc. | Loss or gain. |
|---|---|---|---|
| $SiO_2$ | 23.09 | 23.55 | +0.46 |
| $Al_2O_3$ | 6.100 | 6.51 | +0.41 |
| $TiO_2$ | 0.30 | 0.28 | —0.02 |
| $Fe_2O_3$ | 2.25 | 2.51 | +0.26 |
| FeO | ..... | ..... | ...... |
| MnO | 0.09 | 0.08 | —0.01 |
| CaO | 63.30 | 63.10 | —0.20 |
| MgO | 2.43 | 2.48 | +0.05 |
| $Na_2O$ | 0.32 | 0.26 | —0.06 |
| $K_2O$ | 0.94 | 0.50 | —0.44 |
| $P_2O_5$ | 0.27 | 0.25 | —0.02 |
| $SO_3$ | 0.91 | 0.48 | —0.43 |

EXPERIMENT B.

| | Raw material calculated to a clinker. | Clinker calculated without its $H_2O$, $CO_2$, etc. | Loss or gain. |
|---|---|---|---|
| $SiO_2$ | 19.65 | 20.37 | +0.72 |
| $Al_2O_3$ | 6.87 | 7.19 | +0.32 |
| $TiO_2$ | 0.30 | 0.27 | —0.03 |
| $Fe_2O_3$ | 2.15 | 2.45 | +0.30 |
| FeO | ..... | ..... | ...... |
| MnO | 0.08 | 0.08 | ...... |
| CaO | 64.95 | 65.04 | +0.09 |
| MgO | 3.12 | 3.04 | —0.08 |
| $Na_2O$ | 0.43 | 0.31 | —0.12 |
| $K_2O$ | 0.99 | 0.48 | —0.51 |
| $P_2O_5$ | 0.30 | 0.31 | +0.01 |
| $SO_3$ | 1.18 | 0.46 | —0.72 |

EXPERIMENT C.

| | Raw material calculated to a clinker. | Clinker calculated without its $H_2O$, $CO_2$, etc. | Loss or gain. |
|---|---|---|---|
| $SiO_2$ | 20.47 | 21.14 | +0.67 |
| $TiO_2$ | 0.35 | 0.32 | —0.03 |
| $Al_2O_3$ | 6.93 | 7.32 | +0.39 |
| $Fe_2O_3$ | 2.34 | 2.66 | +0.32 |
| FeO | ..... | ..... | ..... |
| MnO | 0.09 | 0.09 | 0.00 |
| CaO | 63.72 | 63.80 | +0.08 |
| MgO | 2.94 | 2.97 | +0.03 |
| $Na_2O$ | 0.47 | 0.38 | —0.09 |
| $K_2O$ | 1.10 | 0.59 | —0.51 |
| $P_2O_5$ | 0.34 | 0.34 | 0.00 |
| $SO_3$ | 1.25 | 0.38 | —0.87 |

The analysis of the coal used is as follows:

| | | |
|---|---|---|
| Moisture | | 1.34 |
| Volatile and combustible matter | | 34.11 |
| Fixed carbon | | 54.03 |
| Ash—$SiO_2$ | 3.59 | |
| $TiO_2$ | 0.08 | |
| $Al_2O_3$ | 1.50 | |
| $Fe_2O_3$ | 1.91 | |
| MnO | 0.03 | |
| CaO | 0.75 | |
| MgO | 0.03 | |
| $Na_2O$ | 0.10 | |
| $K_2O$ | 0.16 | |
| $P_2O_5$ | 0.06 | |
| $SO_3$ | 0.54 | |
| | | 8.75 |
| Sulphur | | 1.77 |

An inspection of the results shows: A passing through the kiln of most of the coal ashes; a loss of practically all the carbon dioxide and water; almost complete oxidation of the iron; a large loss of sulphur and almost complete oxidation of the remainder; a large loss of alkalies; practically no losses of titanic oxide, phosphoric oxide or manganese.

As a confirmation of the statement of the losses, the analysis of a deposit which collects just below the mouth of the kiln stacks, is given.

| | |
|---|---|
| $SiO_2$ | 16.54 |
| $TiO_2$ | 0.53 |
| $Al_2O_3$ | 5.83 |
| $Fe_2O_3$ | 6.81 |
| MnO | 0.22 |
| CaO | 30.99 |

| | |
|---|---|
| MgO | 1.63 |
| $Na_2O$ | 1.38 |
| $K_2O$ | 6.83 |
| $P_2O_5$ | 6.25 |
| $SO_3$ | 28.77 |
| S | 0.33 |
| $CO_2$ | 0.22 |
| $H_2O$ | 0.15 |

S. P. SADTLER.

**Proper Methods in Conducting Painting Tests.** BY GUSTAVE W. THOMPSON. *Chem. Eng.*, August, 1905.—The best way to examine a paint is to use it on a large scale, but decisions generally have to be made in a shorter time than this requires. Such field tests should be accompanied by laboratory tests. Covering power is influenced by the light-absorbing qualities of the particles and the difference in the indices of refraction of the pigment and the vehicle. To be compared, two paints should have practically the same color and tone. The covering power of most paints depends on the covering power of the white pigment. The proper consistency must be decided by practice, but when found satisfactory, its formula should be made a matter of record. The covering power, when of proper consistency, should be in the neighborhood of 1,200 sq. ft. per gallon. A practical method of comparing paints as to covering power, etc., is to analyze them, making a record of the volumes of both pigment and vehicles and then to spread them at the same rate, say 1,200 sq. ft. per gallon; to note their comparative values for hiding the surfaces over which they are spread. Three rough boards 30 by 10 inches are used, joined with white lead, and a black diagonal strip of lampblack in Japan 1 inch wide. Tested in this way notably better covering power was observed for white lead than for barytes. S. P. SADTLER.

**The Design and Construction of Small Chemical Laboratories.** *Chem. Eng.*, August, 1905.—Pulverizing mills and mechanically driven agate mortars. S. P. SADTLER.

**A Brief Outline of Gas Works Chemistry.** THE FINISHED GAS. BY H. B. HARROP. *Chem. Eng.*, August, 1905.—The average composition of finished coal gas is: Hydrogen, $^1/_2$ or a little less; paraffins, $^1/_3$, recorded as methane; carbon monoxide, $^1/_{10}$; heavy hydrocarbon gases, calculated as ethylene, 5 to 6 per cent.; a small proportion of benzene; and a minute amount of solid products, such as naphthalene. Besides these there is carbon dioxide, 1 to 2 per cent.; oxygen, from a trace to ½ per cent.; nitrogen, 3 or more per cent.; and sulphur compounds to make 20 to 30 grains per 100 feet. The analysis is best made with the Hempel apparatus, although frequently made with the Orsat and some-

times with the Elliott, using bromine as an absorbent for the ethylene. As a text-book for gas analysis, reference is made to Hempel and Dennis. Hempel's method of absorbing benzene by means of alcohol is declared obsolete, and two improved methods are mentioned, one which appeared in this Journal (reference not given), and are suggested by the author, in which differences in volume which the sample in question takes from contact with the benzene are used. If no benzene is present, the calculated difference in volume will be observed and lesser differences up to the point of the gas being completely charged at the temperature of observation.

A table of benzene vapor pressure worked out by the author, is here given:

| | |
|---|---|
| 50° F. (10° C.) | = 1.709 inches. |
| 60° F. (15.6° C.) | = 2.366 " |
| 70° F. (21.1° C.) | = 3.256 " |
| 80° F. (26.7° C.) | = 4.539 " |

The only method of estimating naphthalene is found in Abady's "Gas Analysts' Manual." The specific gravity of the finished gas is given as a valuable indication of the amount of impurities. Coal gas is about 0.45 (air = 1.0) while $N_2 = 0.97$, $O_2 = 1.11$, $H_2S = 1.18$, $CO_2 = 1.53$. The specific gravity is easily obtained by weighing a light glass globe first with gas and then with air or by Schilling's modification of Graham's diffusion method. The Junker calorimeter is the only apparatus for measuring the heating value of a gas. It is easily and quickly operated. The net heat (burning without condensation) is determined by catching the condensed water and deducting the latent heat of vaporization of this amount of water from the total heat found. Where this calorimeter is used daily, a titration of this condensed water by means of centi-normal sodium carbonate solution affords a good check of the sulphur in the gas. Where a calorimeter is not available the heat is determined from the analyses.

PART II.—MANUFACTURE OF COAL GAS.

A description of the making of producer gas used for firing retorts, is given. Some specific heats at high temperatures are given in order to calculate the flame temperature of producer gas (2814° F.) and the loss of heat in waste gases.

Mean specific heat $CO_2$, 2800° to 3000° = 0.37; at 1000° = 0.27
" " " $H_2O$, 2800° to 3000° = 0.84; at 1000° = 0.65
" " " $N_2$, 2800° to 3000° = 0.31; at 1000° = 0.26

S. P. SADTLER.

## AGRICULTURAL CHEMISTRY.

**Report of State Analyst.** BY E. N. EATON. From the *Report of the State Food Commissioner of Illinois for 1903*.—The report

includes the results of the examination of 1,446 samples of which 1,356 were taken by the authorized inspectors of the state. Of these, 906, or 66.8 per cent., were found to conform with the laws of the state. The results obtained with each class of foods is given in a detailed tabular statement The report also includes in tabular form a resumé of the entire work, which is given below.

RESUMÉ.

| Food-stuff. | Pure. | Adulterated. | Total. | Percentage pure. | Percentage adulterated. |
|---|---|---|---|---|---|
| Allspice | 16 | ..... | 16 | 100 | ...... |
| Baking-powder | 2 | 7 | 9 | 22 | 78 |
| Buckwheat flour | 8 | 4 | 12 | 65 | 35 |
| Butter | 22 | 16 | 38 | 57.9 | 42.1 |
| Butter sent in | ..... | ..... | 29 | ...... | ...... |
| Candy | 111 | 2 | 113 | 98.2 | 1.8 |
| Cinnamon | 5 | ..... | 5 | 100 | ...... |
| Cloves | 4 | 2 | 6 | 66.6 | 33.4 |
| Cocoa and chocolate | 10 | ..... | 10 | 100 | ...... |
| Cream | 9 | ..... | 9 | 100 | ...... |
| Extracts other than lemon and vanilla | 13 | 2 | 15 | 86.6 | 13.4 |
| Ginger | 1 | ..... | 1 | 100 | ...... |
| Honey | 28 | 7 | 35 | 80 | 20 |
| Jellies and jams | 9 | 17 | 26 | 34.6 | 65.4 |
| Jellies and jams sent in | ..... | ..... | 2 | ...... | ...... |
| Lemon extracts | 69 | 108 | 177 | 38.9 | 61.1 |
| Maple syrup | 29 | 20 | 49 | 59.2 | 40.8 |
| Milk | 273 | 48 | 321 | 81.9 | 18.1 |
| Milk sent in | ..... | ..... | 28 | ...... | ...... |
| Miscellaneous | 20 | 4 | 24 | 83.3 | 16.7 |
| Pepper | 12 | 2 | 14 | 90 | 10 |
| Preservatives | ..... | ..... | 9 | ...... | ...... |
| Soda fountain syrups | 22 | 51 | 73 | 30.1 | 69.9 |
| Sorghum, syrups and molasses | 19 | 21 | 40 | 47.5 | 52.5 |
| Vanilla extracts | 79 | 59 | 138 | 57.2 | 42.8 |
| Vinegar | 145 | 80 | 225 | 64.4 | 35.6 |
| Totals | 906 | 450 | 1446 | ...... | ...... |

W. D. BIGELOW.

**Report of State Analyst.** BY E. N. EATON. *Report of the State Food Commissioner of Illinois for 1904.*—The results of the examination of 1,718 samples of foods are given of which 1,152, or 67 per cent., were found to comply with the requirements of the laws of Illinois. The following table gives the percentage of samples found not to comply with the law in each year since the establishment of food inspection in the state. It must be understood, of course, that these figures do not give the actual state of

the foods on the market because of the fact that only those suspected to be adulterated are sampled by inspectors.

COMPARATIVE TABLE OF ADULTERATION—1900 TO 1904 INCLUSIVE.

| Article of food. | 1900. | 1901. | 1902. | 1903. | 1904. | |
|---|---|---|---|---|---|---|
| Allspice | 00 | 00 | 00 | 00 | 5 | |
| Baking-powder | 100 | 100 | 100 | 78 | 100 | |
| Butter | 73 | 70 | 68 | 42 | 14 | |
| Buckwheat | 00 | 31 | ...... | 35 | ..... | |
| Candy | ..... | .. .. | ...... | 1.8 | ..... | |
| Canned goods | ..... | 12 | ...... | . .... | ..... | |
| Catsup | 96 | ..... | ...... | ...... | ..... | |
| Cinnamon | ..... | 00 | 00 | 00 | 9 | |
| Cloves | ..... | 44 | 33 | 33 | 27 | |
| Cayenne | ..... | ..... | 33 | ...... | 7 | |
| Coffee | 00 | 11 | ...... | ...... | ..... | |
| Cocoa and chocolate | ..... | ..... | ...... | 00 | ..... | |
| Cocoa | ..... | 20 | ...... | ...... | 19 | |
| Chocolate | ..... | 32 | ...... | ...... | 19 | |
| Condensed milk | 18 | ..... | ...... | ...... | 45 | |
| Cream | ..... | 00 | 39 | 00 | 14 | |
| Cream of tartar | 18 | 7.5 | ...... | ...... | 4 | |
| Ginger | ..... | ..... | 7 | ...... | 3 | |
| Grape juice | ..... | ..... | 78 | ...... | ..... | |
| Honey | 41 | 20 | 00 | 20 | 33 | |
| Jellies and jams | 70 | 54 | 100 | 20 | 66 | |
| Lard | ..... | ..... | 5 | ...... | ..... | |
| Lemon extract | 70 | 43 | 73 | 61 | 58 | |
| Mace | ..... | ..... | ...... | ...... | 100 | |
| Maple syrup | ..... | 34 | ...... | 40 | ..... | |
| Maple sugar | ..... | 48 | ...... | ...... | ..... | |
| Milk chocolate | ..... | ..... | ...... | ...... | 00 | |
| Milk | 17 | 17 | 31 | 18 | 19 | |
| Mince meat | ..... | ..... | ...... | ...... | 75 | |
| Mustard | ..... | 33 | 17 | ...... | 15 | |
| Nutmeg | ..... | ..... | ...... | ...... | 00 | |
| Oleomargarine | ..... | 40 | ...... | ...... | ..... | Sold for butter |
| Prepared cereal foods | ..... | ..... | 00 | ...... | 00 | |
| Olive oil | 52 | 30 | ...... | ...... | 00 | |
| Pepper | ..... | 47 | 30 | 10 | 32 | |
| Prepared foods | ..... | ..... | 00 | ...... | .... | |
| Soda water syrups | ..... | ..... | 73 | 70 | 71 | |
| Sorghum and molasses | ..... | 50 | 100 | 53 | 71 | |
| Vanilla extract | 77 | 53 | 60 | 43 | 28 | Including syrups |
| Vinegar | 54 | 53 | 45 | 35 | 40 | |

The results of the examination of each class of foods are given in tabular form and a table is also given which contains a general resumé of the work of the year.

**Resume.**

| Article. | No. examined. | No. pure. | No. adulterated. | Percentage pure. | Percentage adulterated. |
|---|---|---|---|---|---|
| Allspice | 63 | 60 | 3 | 94 | 5 |
| Baking-powder | 69 | 0 | 69 | ... | 100 |
| Butter | 7 | 6 | 1 | 86 | 14 |
| Candy | 2 | ... | 2 | ... | ... |
| Cinnamon | 68 | 63 | 5 | 91 | 9 |
| Cloves | 85 | 62 | 23 | 73 | 27 |
| Condensed milk | 22 | 12 | 10 | 54.5 | 45.5 |
| Coca Cola | 5 | 5 | 0 | ...... | ...... |
| Cocoa and chocolate | 64 | 52 | 12 | 81 | 19 |
| Cream | 21 | 18 | 3 | 86 | 14 |
| Cream of tartar | 23 | 22 | 1 | 96 | 4 |
| Flavoring extracts, miscellaneous | 8 | 5 | 3 | 63 | 37 |
| Flour buckwheat | 1 | 1 | ... | 100 | 00 |
| Ginger | 57 | 55 | 2 | 96.5 | 3.5 |
| Honey | 9 | 6 | 3 | 66 | 33 |
| Jellies and jams | 79 | 27 | 52 | 34 | 66 |
| Lemon extract | 147 | 61 | 86 | 41.5 | 58.5 |
| Mace | 12 | 0 | 12 | 0 | 100 |
| Milk | 302 | 243 | 59 | 80.5 | 19.5 |
| Milk chocolate | 7 | 7 | 0 | 100 | 00 |
| Mince meat | 4 | 1 | 3 | 25 | 75 |
| Miscellaneous | 22 | 16 | 6 | 73 | 27 |
| Mustard | 58 | 49 | 9 | 84.5 | 15.5 |
| Nutmeg | 6 | 6 | 0 | 100 | 00 |
| Olive oil | 13 | 13 | 0 | 100 | 00 |
| Pepper—black | 94 | 61 | 33 | 65 | 35 |
| " —white | 41 | 31 | 10 | 76 | 27 |
| " —red | 40 | 37 | 3 | 92.5 | 7.5 |
| Prepared cereal foods | 13 | 13 | 00 | ...... | ...... |
| Salad oil | 2 | 2 | 0 | 100 | ...... |
| Syrups | 21 | 6 | 15 | 29 | 71 |
| Soda-water syrups | 45 | 13 | 32 | 29 | 71 |
| Sugar-colored | 3 | 1 | 2 | ...... | ...... |
| Vanilla extract | 126 | 90 | 36 | 71.5 | 28.5 |
| Vinegar | 179 | 108 | 71 | 60 | 40 |
| Totals | 1718 | 1152 | 566 | 67 | 33 |

W. D. Bigelow.

**Digestion Experiments.** By J. M. Bartlett. *Bull. 110, Maine Agr. Expt. Sta.*—This bulletin contains the report of digestion experiments made in the years 1901–1904. A detailed tabulation of all results is given. "Of the animals used in these experiments the steers had a greater capacity for digesting coarse fodders low in protein, like timothy hay and corn fodders,

than the sheep." "The more nitrogenous rations were as well and in some cases better digested by the sheep than by the steers, and the addition of nitrogenous grains to the ration appeared to materially increase the sheep's digestive capacity." "The feeding of grain rich in protein with corn-meal apparently increased the digestibility of the ration, particularly that of the protein." "It is evident from a study of these results and others before published that as great differences in digestion coefficients will occur between sheep, individually, as is likely to occur between sheep and steers. But if sheep are to be used to determine coefficients for bovines, great care should be taken to select strong animals that are good feeders and will eat coarse fodders readily; otherwise results which are too low are likely to be obtained." The income and outgo of nitrogen is also reported.

W. D. BIGELOW.

**Fish as Food.** BY C. F. LANGWORTHY. *Farmers' Bull. 85, U. S. Dept. of Agr.*—This bulletin is a revision of the earlier bulletin of the same number. It contains in addition to discussions regarding the composition, nutritive value, digestibility, and relative cost of fish, a discussion of methods for preparing fish for the table, a list of desirable menus containing fish, and considerable statistical information (brought up to date) regarding the fishery industry. The bulletin closes with a chapter on possible dangers from eating fish. W. D. BIGELOW.

**Report of the North Dakota Food Commissioner for 1904.** BY E. F. LADD.—The report discusses in detail the requirements of the North Dakota food law and discusses in considerable detail the problems attending the use of ordinary adulterants in a wide range of food products. The reasons for, and the objections to using preservatives, artificial coloring-matter, saccharin, several "make-weights" and commercial adulterants and the question of proper labeling are also discussed. The results of a large amount of analytical work are given in detail. The report does not contain a tabulated statement. W. D. BIGELOW.

**Colorado Hays and Fodders.** BY WILLIAM P. HEADEN. *Bull. 93, Colo. Agr. Expt. Sta.*—The report gives a compilation of digestion experiments previously published from a number of states; of a large number of hays and fodders as well as the results of the experiments recently conducted with sheep at the Colorado station. W. D. BIGELOW.

**Butter Preservatives.** BY H. H. DEAN AND R. HARCOURT. *Ont. Agr. Coll. Bull. 145.*—The study of the use of various preservatives was undertaken in order that the demands of a foreign trade desiring saltless butter, might be met. Some of these preservatives are such powerful poisons as to preclude their use,

*e. g.*, bichloride of mercury, sugar of lead, etc. A butter preservative must be almost odorless and tasteless; harmless to the system, and yet strong enough in its antiseptic properties to prevent or retard the growth of the lower organisms. The chief substances used as preservatives are (1) boric acid or borates, (2) formalin, (3) salicylic acid, (4) sulphurous acid and sulphites, (5) benzoic acid, (6) fluorides. The toxic action of the boron compounds alone is disputed, that of the others being recognized as harmful. Experiments with 12 young men fed on butter containing 0.5 per cent. of borax for fifty days showed no evil effects on the health of any of them. The amount of borax consumed by each person was about 0.5 gram per day. Ten samples of commercial preservatives, bought on the market, were tested with regard to their butter-preserving power. These butters were scored in comparison with butter preserved with common salt. After forty-five days, the flavor of butter in pound prints preserved with borax scored 41.7, with common salt 37.5. Butter in boxes preserved with borax 37.7, butter in boxes preserved with common salt 35.2. The use of 0.25 per cent. of preservative gave a butter scoring higher than when 0.5 per cent. was used, or when 0.25 per cent. preservative and 0.25 per cent. salt were used and that without imparting a preservative flavor. The results of the experiments were that powdered borax was as good as the commercial preservatives; that 0.25 per cent. borax will preserve butter without giving it any foreign flavor; when butter is to be held over three months, the use of 0.25 per cent. of preservative is recommended. Borax is the only preservative sanctioned. J. A. LeClerc.

**Some Present Problems in Agriculture.** Paper read by L. H. Bailey before Department 18, Section on Agriculture of the International Congress of Arts and Sciences, St. Louis, September 24, 1904. *Science*, May 5, 1905—This paper treats of two kinds of problems (1) "The problems of the business, (2) the problems of adjustment to the affairs of our growing civilization," the latter being of greatest public concern. Agriculture employs, and must employ, one-fifth to one-fourth of the people It is a basic occupation and not supernumerary, eleemosynary or parasitic. As a lover of peace, and as a wealth producer, the farmer will demand more and more a voice "in the waste of wealth in maintaining armaments of war." The Land Grant Act, a member of the Cabinet representing agriculture, the Experiment Station Act, the farmers' institute movement, the fertilizer and feeding stuff controls, etc., all show that agricultural problems are of greatest national significance The farmer has avoided the real difficulties of agriculture by moving westward to virgin soil. When this land is all taken then will scientific agriculture be born.

*The Technical Agricultural Problems.*—From 1870–1900, the

population has practically doubled and likewise has our agricultural area. The development of railroads, the improvement in machinery, such as the self-binding harvester, have aided materially in this progress. In 1821 the first instruction in agriculture was given in the lyceum at Gardiner, Maine, and in 1824 a school of agriculture was opened at Derby, Conn. Of the several agricultural institutions started before the Land Grant Act in 1863, only the Michigan Agricultural College survives. The difficulties of the farmer needed attention; they were of two kinds (1) "to remove the special disabilities (insects, fungi, weeds, animal diseases), (2) to augment production (fertilizers, soil studies, tillage, improving plants and animals"). The Experiment Station was born in 1887. Its object is "to conduct original researches and verify the experiments on the physiology of plants and animals; their diseases and remedies; the chemical composition of plants during the growing period; the rotation of crops; the acclimation of plants; analyses of soils and water; the composition of fertilizers, and experiments with them; the composition and digestibility of foods for animals; dairy problems; etc., etc." Over 300 bulletins were issued by the Experiment Stations in 1903, most of them concerning insects and diseases of plants; feeding; fertilizers; farm crops; fruits; and dairy; three of them were educational, two on forestry. The fertilizer epoch based on agricultural chemistry is now passing and larger questions are now demanding solution, *viz.*, (1) "problems of feeding to increase efficiency of farm animals, (2) problems of breeding animals and plants for the same purpose, (3) problems of the business organization of the farm, or the development of a farm plan."

*The Social and Economic Problems—viz.*, the farmer's relation to good roads, schools, the church, and to social forces; attention must be given to the ideals of living: sanitation, architecture, reading, the bringing up of children, social and commercial organization. The country must be made attractive and habitable so as to attract the best men and women. To improve the ideals of the farmer, is one of the greatest public questions. The farmer is conservative, whereas we live in a dynamic social age. The rural mail delivery (shall he have the parcel post?), good roads, the telephone, the electric lines, extensional education, are all servants of the farmer. Coöperation and organization movements are growing. Farming enterprises can never be syndicated and monopolized to the same extent as other enterprises. Farming is individual rather than collective. Nature is the source of all art. In time she will express her full beauty and power. All objectionable features will be removed from the landscape—untidiness, blemishes, advertising signs, unharmonious buildings; pictures will be made with the natural materials—the sward, trees, streams, hills and flowers. The school is the chief force that shall revitalize and recrystallize the country. The country

school has remained practically stationary. More people leave the farm to educate their children than for all other causes. The rural schools should be abolished, and every boy and girl, whatever the occupation of the parent, should be given the opportunity of securing the same, or equally efficient, education. Agricultural literature, in its broadest sense, will develop and nationalize agricultural sentiment. J. A. LeClerc.

**Legumes Other than Alfalfa.** By C. D. Smith. *Mich. Agr. Expt. Sta. Bull. 227.*—This bulletin describes many of the legumes, other than alfalfa, grown in Michigan, and gives the chemical composition of the stalks of the Whippoorwill variety of cowpeas as follows:

| | Per cent. |
|---|---|
| Water | 23.34 |
| Ash | 8.84 |
| Nitrogen | 1.23 |
| Potash | trace |
| Phosphoric acid | 0.95 |

The water, organic matter, ash, nitrogen, potash and phosphoric acid content of the forage, roots and nodules of several varieties of legumes is also given.

Soy beans were put into a silo, the silage having the following composition:

| | Per cent. |
|---|---|
| Water | 68.87 |
| Ash | 5.69 |
| Ether extract | 2.97 |
| Fiber | 9.09 |
| Carbohydrates | 10.00 |
| Protein | 3.28 |

This silage had a disagreeable odor, and when fed to dairy cows, an unpleasant flavor was noticed in the butter.

J. A. LeClerc.

**Concentrated Feeding Stuffs.** *Pa. Dept. Agr. Bull. 122, R. I. Expt. Sta. Bull. 105.* J. A. LeClerc.

**Relative Values of Feeding Stuffs.** By H. P. Armsby. *Penn. State Coll. Agr. Expt. Sta. Bull. 71.*—This bulletin contains the results of experiments in coöperation with the Bureau of Animal Industry of the United States Department of Agriculture, in which the values of feeding-stuffs both for maintenance and for fattening were determined by the aid of the respiration calorimeter. These values were found to be considerably lower than those computed according to the ordinary methods from the per cent. of digestible matter. However, as the figures here given are the result of only one or two determinations upon a

single animal, they must be considered only as suggestive and not as final. J. A. LECLERC.

**Wyoming Forage Plants and their Chemical Composition.** BY H. G. KNIGHT, F. E. HEPNER, AND AVEN NELSON. *Wyo. Agr. Expt. Bull. 65.*—This bulletin is the first of a series of studies both botanical and chemical of the Wyoming native and introduced true grasses, sedges, rushes, legumes, salt-bushes, sage-brush, etc. The analyses of some two dozen of these plants, air-dried, are given; likewise the percentage composition computed on the basis of the green sample and water-free sample. Cuts illustrating these plants are included in the bulletin. The composition of these forage plants, compared with eastern forage plants, shows a higher per cent. of crude fiber and protein, but a lower per cent. of fat. J. A. LECLERC.

**The Variability of Wheat Varieties in Resistance to Toxic Salts.** BY L. L. HARTER. *Bull. 79, Bureau of Plant Industry, U. S. Dept. of Agr.*—The author, using the well-known methods of experiment and of establishing the toxic limits, has obtained the results given in the table. The results are expressed in fractions of a normal solution.

| Name of wheat. Variety. | Magnesium sulphate. | Magnesium chloride. | Sodium carbonate. | Sodium bicarbonate. | Sodium sulphate. | Sodium chloride. |
|---|---|---|---|---|---|---|
| Zimmerman | 0.0075 | 0.015 | 0.0125 | 0.028 | 0.05 | 0.065 |
| Kharkof | 0.00625 | 0.01 | 0.015 | 0.03 | 0.0425 | 0.055 |
| Padui | 0.0075 | 0.01 | 0.01 | 0.0275 | 0.045 | 0.0575 |
| Kubanka | 0.0075 | 0.00875 | 0.0075 | 0.025 | 0.05 | 0.0575 |
| Turkey | 0.01 | 0.0075 | 0.015 | 0.0275 | 0.0425 | 0.05 |
| Maraouani | 0.0075 | 0.01 | 0.008 | 0.0225 | 0.0475 | 0.055 |
| Budapest | 0.01 | 0.0125 | 0.005 | 0.025 | 0.0375 | 0.0475 |
| Preston | 0.005 | 0.005 | 0.0125 | 0.025 | 0.035 | 0.055 |
| Chul | 0.005 | 0.005 | 0.0125 | 0.025 | 0.04 | 0.045 |
| Average | 0.00736 | 0.0093 | 0.0109 | 0.026 | 0.0433 | 0.0542 |

"A comparison of the resistance of the different varieties with the region from which they came in respect to soil and climatic conditions shows that their resistance to saline solutions can probably be correlated with the natural habitat of the varieties; that is, the results herein obtained indicate that a variety grown in a locality having little or no excess of salts in the soil has a comparatively low resistance in saline water cultures. It further shows that varieties grown in regions having more saline soils have a much greater resistance in saline water cultures." Some doubt was cast upon the value of the results by the discovery that the distilled water used in preparing the salt solutions contained enough zinc to make it decidedly toxic to wheat, but as very dilute salt solution neutralized the toxicity (compared with water distilled from glass and with hydrant water also) the

author deems the results acceptable. Considerable individual variability was found to exist within several of the varieties. The frequently observed stimulating effect of dilute solutions is noted in these experiments. The literature on the subject of toxicity of salts to plants is frequently referred to and a bibliography is appended. F. P. VEITCH.

**Fertilizer Experiments, 1897-1905.** BY C. F. ECKART. *Bull. 15, Expt. Sta. Hawaiian Sugar Planters' Association.*—The highest yields of sugar per acre were obtained where complete fertilizers (nitrate and ammonium sulphate) were used, though these yields were closely approached by combination of any two essential elements. On the whole, nitrogen appears to be the most deficient element. Phosphates or potassium sulphate used alone gave but little increase and decreased the yield in some instances.

**Commercial Fertilizers.** BY J. L. HILLS, C. H. JONES AND F. M. HOLLISTER. *Bull. 116, Vt. Agr. Expt. Sta.*—In this bulletin the following subjects are discussed quite thoroughly: results of fertilizer inspection; relation of selling price to valuation; how, when and what to use, and tables of analyses of brands collected during the current year are given, together with a comparison of the analyses of various fertilizers for the past five years. Under the head of how, when and what to use, the various methods that are of service in indicating manurial needs are briefly stated in general terms and the limitations of each pointed out. The general requirements of different classes of plants on different types of soil are stated and numerous formulae for all kinds of crops are given. These are given simply as suggestions and not as applicable under all conditions.

**Fertilizer Analyses.** BY A. J. PATTEN. *Bull. 232, Michigan Agr. Expt. Sta.*—Tabulated analyses of a number of brands. F. P. VEITCH.

**Some Studies in Indoor Lettuce Culture.** BY W. STUART. *17th Ann. Report Vt. Agr. Expt. Sta.*—There are indications that large applications of raw bone-meal decidedly increase the yield, while nitrate of soda and dried blood are of about equal value as nitrogen carriers. Well-rotted manure gave the best yields and sub-watering was better than surface-watering.

F. P. VEITCH.

**Report on Soils.** BY C. G. HOPKINS. Reprint from *Bull. 90, Bureau of Chemistry, U. S. Dept. of Agr.*—A report of the referee of the A. O. A. C. on the determination of phosphorus and potassium in a water extract and a dilute acid extract from a fertile soil and from an infertile soil by official methods of analysis and by colorimetric methods, with brief discussion and comments of those participating in the work. The results obtained by

each method differed widely among themselves, as did also the results by different methods. It is recommended that the work be continued. F. P. VEITCH.

**Analyses of Commercial Fertilizers.** *Bull. 115, S. C. Agr. Expt. Sta.*—Discussion of fertilizer constituents, commercial valuation and tabulated analyses of a number of brands and raw materials. F. P. VEITCH.

**Miscellaneous Water Analyses.** *Bull. 67, Okla. Agr. Expt. Sta.*—Brief discussion and more or less complete analyses of 126 samples of well, spring, cistern, and rain waters, collected from different parts of the state. F. P. VEITCH.

**Plant-food Constituents Used by Bearing Fruit Trees.** BY L. L. VAN SLYKE, O. M. TAYLOR AND W. H. ANDREWS. *Bull. 265, New York Agr. Expt. Sta.* (Geneva).—For the purpose of ascertaining the amounts of nitrogen, phosphoric acid, potash, lime and magnesia removed in one growing season by bearing fruit trees, three standard varieties of apple, peach, pear, plum and quince were selected and the fruit, leaves and new growth of wood were carefully gathered, weighed and analyzed, with the following results:

AMOUNTS OF NITROGEN, ETC., USED PER ACRE BY DIFFERENT PARTS OF TREE.

| Part of tree. | Variety of fruit tree. | Nitrogen. Lbs. | Phosphoric acid ($P_2O_5$). Lbs. | Potash ($K_2O$). Lbs. | Lime (CaO). Lbs. | Magnesia (MgO). Lbs. |
|---|---|---|---|---|---|---|
| Fruit | Apple | 20.0 | 8.5 | 45.0 | 3.9 | 6.4 |
| " | Peach | 17.5 | 8.6 | 36.0 | 2.2 | 4.1 |
| " | Pear | 9.0 | 3.2 | 20.2 | 2.2 | 2.6 |
| " | Plum | 13.3 | 4.7 | 18.5 | 4.4 | 3.0 |
| " | Quince | 22.0 | 10.0 | 44.4 | 3.4 | 6.0 |
| " | Average | 16.4 | 7.0 | 32.8 | 3.2 | 4.4 |
| Leaves | Apple | 30.3 | 4.8 | 9.5 | 49.7 | 16.3 |
| " | Peach | 50.4 | 8.0 | 32.9 | 94.6 | 28.5 |
| " | Pear | 18.5 | 3.0 | 10.7 | 30.7 | 7.2 |
| " | Plum | 13.2 | 2.9 | 17.6 | 26.8 | 8.5 |
| " | Quince | 20.4 | 4.1 | 9.8 | 46.1 | 11.0 |
| " | Average | 26.6 | 4.6 | 16.1 | 49.6 | 14.3 |
| New wood | Apple | 1.1 | 0.4 | 0.6 | 3.0 | 0.6 |
| " " | Peach | 6.6 | 1.6 | 3.4 | 17.4 | 2.6 |
| " " | Pear | 2.2 | 0.8 | 2.0 | 5.4 | 1.1 |
| " " | Plum | 3.0 | 1.0 | 1.8 | 10.0 | 1.5 |
| " " | Quince | 3.1 | 1.2 | 2.6 | 16.1 | 1.9 |
| " " | Average | 3.2 | 1.0 | 2.1 | 10.4 | 1.5 |

F. P. VEITCH.

**Commercial Fertilizers.** *Bull. 117, Ky. Agr. Expt. Sta.*—The bulletin contains tabulated analyses of many brands of fertilizers offered for sale in Kentucky.

**Ohio Soil Studies: I. Chemical and Mechanical Analyses of the Soils under Experiment.** BY A. D. SELBY AND JNO. W. AMES. *Bull. 150, Ohio Agr. Expt. Sta.*—The geological origin and original forest growth and general characteristics of the soils at the several stations located at Wooster, Columbus, Strongville, Neapolis, Germantown and Carpenter are discussed and chemical and mechanical analyses of many unfertilized plots, representing closely the conditions at the beginning of experimental work in the several localities, are given. In making the mechanical analyses the Osbourne beaker method was used and the chemical analyses were made by the well-known method of treating with 1.115 hydrochloric acid. Both the mechanical and chemical analyses show considerable differences in composition between duplicate plots of the same series. The characteristics brought out most prominently are the silty or sandy-silty nature of the soils and their low lime content. Soil acidity, ratio of the elements found in the soil, the calcium, magnesium ratios in relation to plant growth, solubility of various mechanical separates and the biological soil factors are discussed in general terms, the authors concluding that "the soil life, not the soil itself, is the factor after all that demands the maximum consideration and study." F. P. VEITCH.

**The Principal Soil Areas of Iowa.** BY W. H. STEVENSON, G. I. CHRISTIE AND O. W. WILCOX. *Bull. 82, Iowa. Agr. Expt. Sta.*—This bulletin contains .. classification based on the geological origin of the soils of the state and discusses the drainage, cultural and plant food characteristics and needs of the several soil areas. A word of warning is uttered against applying the experimental results obtained on one class of soil to soils of different origin and nature. F. P. VEITCH.

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## PATENTS.

### MARCH 7, 1905.

784,107. Heinrich C. Fehrlin, Schaffhausen Switzerland. **Pyrocatechuic alkyl ethers.** Alkaline salts of pyrocatechuic alkyl ethers are mixed with aqueous solutions of albumen, the mixture heated with hydrochloric acid, the reaction product separated, washed and dried, then heated to from 115° to 120° C. This product is soluble in alkaline solutions but insoluble in water, alcohol and dilute acids.

784,124. Ferdinand L. Ramon, San Francisco, Cal. Assignor one-half to Percy D. Bailey, same place. **Hardening iron.** Iron and aluminum are heated together in a crucible to a white heat, and a little sulphur added just before pouring.

784,302. Charles H. Carpenter, So. Bend, Ind. Assignor to John L. White, same place. **Composition fuel.** Peat 195, salt 1, and rosin 4 parts are mixed and briquetted under high pressure.

784,318. Jerome S. Gregg, Pomona, Mich. **Pipe compound.** Cement and sand equal parts, resin, glue and water sufficient to make the mixture plastic.

784,346 Eugene Pilsoudsky and Eugene Ragouzin, St. Petersburg, Russia. **Electrical culture.** Adjacent parallel sections of the earth to be treated are subjected to the action of galvanic currents flowing in opposite directions between buried plates of dissimilar metals connected by overhead conductors adapted to collect atmospheric electricity.

784,349. Walter Riebensahm, Berlin, Germany. **Agar agar.** A limpid solution is made by boiling agar agar under pressure in water acidulated by 1.5 per cent. of citric acid.

784,378. Orlando F. Benton, St. Marys, Ohio. Assignor one-half to Jes e Schimp, same place. Composition for **preserving India rubber goods.** Equal parts of linseed oil and a saturated solution of camphor in turpentine.

784,394. Mark H. Greeley, Ottumwa, Iowa. **Refining butter.** First stirring while heated to 110° to 115° F., drawing off the settlings and skimming it, the melted butter is then drawn off and put through a separator at 90°, pasteurized milk is added and air blown through at 130°, after which the butter is separated and cooled, then allowed to stand eighteen hours before working.

784,407. Joannes C. H. Kramers, Maestricht, and Jacobus G. Aarts, Dongen, Netherlands. Assignors to Water Gas Maatschappy Systeem, Amsterdam, Netherlands. Making **gas.** Steam is passed through a bed of incandescent fuel covered with fresh coal, and the resulting gases run through regenerators till the gas is fixed, the mixture is then passed downwards through a second generator to reduce the carbon dioxide.

784,411. George Merling, Frankfort-on-Main, and Robert Weld, Höchst-on-Main. Assignors to Meister, Lucius und Brüning, Höchst-on-Main. **Perfumes.** Trimethylcyclohexanecarboxylic acids are thick, colorless oils of acid reaction, immiscible with water, soluble in alcohol, ether and benzene, boiling at 140° to 142° C. under 15 mm. without decomposition, and made by eliminating water from hydroxycyclohexanecarboxylic acids by dehydrating agents such as phosphoric anhydride.

784,412. As above for **trimethylhydroxycyclohexanecarboxylic acid** which appears to be a mixture of two substances with different physical modifications, both forming colorless crystals melting at 141 to 143° C. and at 151° to 153° C. under 8 mm. pressure, respectively, difficultly soluble in water, readily soluble in alcohol and ether, and adapted for use in perfumery.

784,474. Arnold Corti, Dubendorf near Zurich, Switzerland. **Paint remover.** Alcohol 500, slaked lime 300, soda 75 parts, then mixing 60 parts of petroleum and 75 of soft soap, stirring all together and finally adding 450 parts of chalk.

784,503. Karl Rucker and Daniel J. Pickee, Berlin, Germany. **Food preservative.** Linseed oil 60, resin 20, shellac 20 parts, and glycerol and wax sufficient to make a flexible coating.

784,512. Nels C. Bille, Balfour, N. D. **Gopher exterminator.** Whiskey 30, vinegar 200, strychnia 15, sugar 125, aniseed oil 1, alum 1, and water 200 parts.

784,527. Charles J. Vernon, Fresno, Cal. **Peeling fruit.** The fruit is cut and pitted, then passed successively through caustic soda and alum solutions, then brushed.

MARCH 14, 1905.

784,621. Paul Klein, Riga, Russia. Process of **manufacturing refractory articles.** Consists in mixing pure hydroxide of lumina, $Al_2(OH)_6$, with from 10 to 80 per cent. of pulverized quartz, molding, pressing and burning the mixture. A new product consisting of silicate of alumina contains upward of 42 per cent. of alumina.

784,640. Robert Suchy, Griesheim-on-the-Main, Germany. Assignor to Chemische Fabrik Griesheim Electron, Frankfort-on-the-Main, Germany. Process of **making chromates.** Heats a mixture of chrome ore and caustic potash to a temperature not exceeding 500° C. in the presence of air, agitating the mixture during heating.

784,870. Burdett Loomis, Hartford, Conn., and Hawley Pettibone, New Rochelle, N. Y. Assignors to Power and Mining Machinery Co., N. Y. **Making gas.** Air is admitted to a body of incandescent fuel, the resulting gases are used to run a gas engine, and the products of combustion from the engine are discharged under pressure into a second body of incandescent fuel for clearing the interstices of ashes and converting the contained water vapor and carbon dioxide into hydrogen and carbon monoxide by passing said products through both bodies of fuel.

784,885. Edward L. Priest, Oakland, Cal. **Electrical extraction of metals.** Reducible ore is formed into a comminuted but coherent mass, connected with a consumable electric conductor, and the mass brought in contact with a liquid electrode, thereby reducing the mass and consuming the conductor.

785,003. Paul Julius, Ludwigshafen-on-Rhine, Germany. Assignor to Badische und Soda Fabrik, same place. **Dichlor-dimethyl-fluorane** Phthalic anhydride is condensed with ortho-chlor-para-cresol, forming colorless crystals soluble in chloroform and hot nitrobenzene, yielding a yellowish green solution with concentrated sulphuric acid, and difficultly soluble in alcohol, ether and benzene.

785,023. Wilson H. Rowley and John H. Montgomery, St. Louis, Mo. Assignors of one-third to Martin Shaughnessy, St. Louis, Mo. Manufacturing **white lead.** Consists in melting the lead, simultaneously atomizing and oxidizing the molten lead, precipitating by jets of water, and finally subjecting to the action of carbon dioxide.

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785,091. George B. Dunbar, Detroit, Mich. **Plastic compound.** A combination of resin 16, litharge 6, shellac 2, Portland cement 8, sand or brick dust 32 parts, and a pigment, with a fibrous material as wood pulp equal to the bulk of the other material.

785,110. Thomas E. Kinney, Waverly, Ohio. **Waterproofing mixture.** Paraffin 90, tallow, beeswax, rosin and linseed oil 2½ parts each.

785,121. Robert E. Schmidt, Elberfeld, Germany. Assignor to the Farbenfabriken of Elberfeld Co., New York, N. Y. **Greenish blue anthraquinone dye.** Treats with formic aldehyde and sulphuric acid the product obtained by heating 1,3-dibromo-2-aminoanthraquinone with cupric chloride, nitrobenzene and sodium acetate.

785,122. As above for **green-blue anthraquinone dye** by treating with formic aldehyde and sulphuric acid the dyestuff described in U. S. Pat. No. 682,523, Sept. 10, 1901.

785,123. Same as above for **green anthraquinone dye** by treating with formic aldehyde and sulphuric acid the product obtained by heating 1-4-diamino-2-3-dibromoanthraquinone with cupric chloride, nitrobenzene and sodium acetate.

785,161. Adolph Frank, Charlottenburg, and Nikodem Caro, Berlin, Germany. Process of making **nitrogen compounds.** A carbide which will not melt at such temperatures is heated from a dull red to a bright yellow heat, is reacted upon by nitrogen, and the cyanide extracted in the usual manner. The reaction by nitrogen may take place in the presence of carbon or of oxygen.

785,167. Eric Hedburg, Joplin, Mo. Assignor, by mesne assignments, to American Reduction Co., Chicago, Ill. Process of separating and **refining complex ores** by drying, crushing, roasting, subjecting while hot to the action of a hydrocarbon gas,

and passing the ore through magnetic fields of progressively increased strength.

785,216. Julius Kantorowicz, Breslau, Germany. Assignor to Farbenfabriken of Elberfeld Co., New York, N. Y. **Starch material.** A white powder, a modified form of starch, which swells up to a paste with cold water, but not dissolving in water like a water-soluble starch. Made by suspending starch in alcohol and adding caustic soda-lye, then neutralizing with acetic acid, filtering, drying and grinding.

785,219. Karl Kieser, Elberfeld, Germany. Assignor to Farbenfabriken of Elberfeld Co., New York, N. Y., for **color-sensitive photographic emulsion** and process of making same, by treating sensitive silver compounds with suitable sensitizing dyestuffs and emulsifying the dyed products.

785,231. Weldon Roberts, Glenridge, and George S. Coxe, Newark, N. J. **Abrading compound.** Rubber 8, sulphur 1, lime 1, emery 80, hair 2, rouge 1, and zinc sulphite 2 parts. A soft rubber compound, the proportions of abrading materials may be varied.

785,312. John W. Langley, Cleveland, Ohio. Process of **purifying water.** For purifying naturally acid water by carbonate of calcium (limestone) and quicklime in connection with an air-blast.

785,396. Joseph H. Aimes, Philadelphia, Pa. Making bituminous or other **pitch concrete pavements.** Quicklime, asphalt and sulphur are powdered, mixed dry, and dampened so that the lime begins to slake, then maltha or asphalt oil is sprinkled over the mass, which is thoroughly mixed.

785,450. August Tixier, Billancourt, and Licien R mbaud, Paris, France. Process of **manufacturing varnishes** by causing an acid to act upon spirits of turpentine to form crystallized terpene, treating the terpene with dilute sulphuric acid to form terpinol, and mixing the terpinol with an ordinary varnish solvent.

785,480. Frederick G. Dokkenwadel, Coshocton, Ohio. Assignor one-half to Harry M. Grant, New York, N. Y. **Blasting compound.** Small shreds of veget ble husks are soaked in sugared water and covered with pulverized sulphur 15, nitrate of soda 40, and nitrate of potash 7 parts. Corn husks are preferred.

785,495. Thomas C. Jeffries, Columbus, Ohio. Process of **enriching earth** by combining with it strong sulphuric acid, lime and salt. Earth, 55 per cent., sulphuric acid 25 per cent., lime and salt, 5 per cent.

785,541. Constantin Danilevsky and Stephan Tourchaninoff, St. Petersburg, Russia, for process of **metallizing fabrics** by impregnating the fabric with the metal by deposition by electrol-

ysis, and subjecting it to the action of a solution of chloride of tin and cyanide of potassium.

785,562. Aaron R. Marsteller, St. Louis, Mo. Composition for **foundry patterns** consisting of coarse sand 10, fine sand 5, oil 1.5, litharge 1, asphalt 0.5 parts.

785,618. James Lappen, Decorah, Iowa. Assignor to L. C. Brooks and L. C. Catlin, St. Paul, Minn. **Retting fibers.** The stock is first boiled in lime-water and then in caustic soda solution both under direct steam pressure.

785,650. Joseph H. Amies, Philadelphia, Pa. **Concrete pavement.** Lime is slaked and immediately the asphalt cement and broken stone are mixed and rolled in the bed, thereby taking advantage of the heat of the lime.

785,675. August L. Laska, Offenbach-on-Main, Germany. Assignor to K. Oehler, Anilin Fabrik, same place. **Orange sulphur dye.** Diazo compounds of volatile aromatic amines are heated with monoacetyl toluylendiamine ($CH_3.NH_2.NH.COCH_3$—1 : 2 : 4) and sulphur in the presence of bases of the diphenyl series, and the product is treated with alkaline compounds. A reddish brown powder insoluble in alcohol and diluted alkali carbonates, slightly soluble in concentrated sulphuric acid and dilute caustic alkali and in alkali sulphides with a yellow-brown color, and dyeing cotton from a sodium sulphide bath orange-yellow shades.

785,696-7. David J. Ogilvy, Cincinnati, Ohio. Making **lamp-black.** Moving or stationary carbonaceous flames are caused to impinge on water in a quiet condition which may contain alkaline salts to overcome the repulsion between the water and the particles of carbon.

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785,715. Frederic A. J. Cournand, Paris, France. Assignor to Ste. Ame de Commentry-Tourchambault et Decazeville, Paris, France **Artificial teeth.** The fixing wire is an alloy of iron and nickel equal parts, the alloy having the same coefficient of expansion as the material of which the tooth is made, fusible at a high temperature, and coated with platinum.

785,733-4. Wilhelm Hess, Frankfort-on-Main, Germany. Obtaining the contents of **yeast cells.** Ethyl acetate is added to moist yeast whereby the contents of the yeast cells are liquefied, and on the addition of water may be separated from the empty yeast cells.

785,791 Anson G. Betts, Troy, N. Y. Making **lead dithionate.** Manganese dioxide is suspended in cold water and sulphur dioxide passed through making manganese dithionate, in which lead peroxide is suspended when manganese peroxide is precipitated and lead dithionate formed.

785,841. Henry G. Turner, London, England. **Furnace lining.** Magnesite is heated in the electric furnace till it crystallizes; it is then cooled, ground, mixed with magnesium chloride and water, molded and baked.

785,851. Caleb C. Balderston, Colora, Md., and Nathaniel H. Brown, Philadelphia, Pa. Assignors to Williams, Brown and Earle, Philadelphia, Pa. **Reflectroscope.** A source of light, a condensing lens, an illuminating lens, an object adjacent and an objective, the light passing through the condensers and illuminating lens onto the object which reflects it through the objective on the screen. For showing opaque objects like engravings, drawings, etc.

785,961. John A. Lyons and Edward C. Broadwell, Chicago, Ill. **Carbon tetrafluoride.** A current of electricity is passed through a fused bath of a positive metal fluoride with a carbon anode surrounded by carbonaceous material that absorbs the fluorine, forming $CF_4$.

785,962. As above for the production of **boron.** In the above arrangement a positive metal borate is substituted for a fluoride. Great current density is maintained at the anode, whereby a very high temperature is maintained and the boric anhydride decomposed to make boron.

786,004. Max Cohn, Berlin, Germany. **Surgical dressings.** Powdered bole is suspended in an aqueous solution of a resin soap to which caustic soda is added, together with benzoic acid, a fabric is saturated therewith, and dried.

786,023. George W. Gesner, New York, N. Y. **Paint.** A pulverized alloy of iron by hydrogen, the latter being at least 0.11 per cent., a vehicle and a drier.

786,028. Johann Hammerschlag, Strasburg, and Hermann S. Gerdes, Jr., and Oscar Droste, Bremen, Germany. **Artificial fuel.** Coke or coal smalls are mixed with peat and solutions of alkalies or ammonia, dried and briquetted.

786,051. Dennis R. Robertson, Leadville, Colo. **Reducing ores** containing gold, silver or copper. Finely divided material in the presence of water is acted on by a sodium salt, ammonia and a potassium salt, agitated with sulphate of iron, iron, water and nitric acid, allowed to rest and the products separated.

786,082. Adolph Wultze, Charlottenburg, Germany. Assignor to Chemisch-Technische Fabrik, Dr. Albert W. Braud and Co., Charlottenburg, Germany. **Coloring natural stones.** A vacuum is first made in which the stones are placed, then dyes are successively injected which are adapted to make colored precipitates in the stone, such as potassium chromate and lead acetate.

WILLIAM H. SEAMAN.

# REVIEW OF AMERICAN CHEMICAL RESEARCH.

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## GENERAL AND PHYSICAL CHEMISTRY.

**An Experiment on the Electrolytic Determination of the Basicity of Acids.** BY IVAN JUEL MOLTKEHAUSEN. *Trans. Am. Electrochem. Soc.*, 4, 39.—The ammonium salt of metaphosphoric acid was prepared by treating copper chloride with phosphoric acid, and treating the resulting copper dimetaphosphate with ammonium sulphide solution. The equivalent conductivity of the salt was then determined at different dilutions, from which, according to Ostwald's empirical rule (Ostwald and Luther, "Hand- und Hülfsbuch," p. 423), the basicity is found to be 2. This salt, therefore, has the formula $(NH_4PO_3)_2 2H_2O$. This does not agree with results obtained by Warschauer, which indicate that the salts of this acid are tetrametaphosphates.

M. DEKAY THOMPSON, JR.

**On the Supposed Electrolysis of Water-Vapor.** BY F. AUSTIN LIDBURY. *Trans. Am. Electrochem. Soc.*, 4, 127.—Sparks are passed through a vessel containing water vapor. The gases liberated at the electrodes are collected, measured, and compared with the amounts of hydrogen and oxygen liberated in an alkaline gas voltameter connected in series with the vessel containing water vapor. The author concludes that "In the partial decomposition of water vapor by the electric discharge, the hydrogen and oxygen liberated tend to separate and to take up different positions in the tube, the hydrogen collecting at both anode and cathode, and the oxygen in the middle of the tube." More water vapor was decomposed by the spark than in the voltameter.

M. DEKAY THOMPSON, JR.

**The Thermochemistry of the Theory of Electrolytic Dissociation.** BY JOSEPH W. RICHARDS. *Trans. Am. Electrochem. Soc.*, 4, 137.—Since the heat of ionization of a compound is small in comparison with the heat of formation in the solid state, the

ionization cannot be a dissociation of the compound into its constituents. Ionization is, therefore a change of physical state. A table of the heat effect accompanying the change of an element in the molecular state to that of the ionized state in dilute solution is calculated, assuming as a basis that the mercury sulphate electrode has a potential of —0.89 volt. The author believes that the heat of neutralization is merely the heat evolved in the condensation of a gaseous molecule into the liquid state.

M. DeKay Thompson, Jr.

**Berthelot's Law Relative to the Electromotive Forces of Cells, Based on the Reciprocal Action of Saline Solutions and Soluble Electrolytes.** By C. J. Reed. *Trans. Am. Electrochem. Soc.*, 4, 151.—In the *Comptes Rendus* for Feb. 16, 1903, Berthelot published a law which states that "When an acid reacts on a base, the electromotive force developed is the sum of the electromotive forces developed when the acid acts on the salt plus that developed when the base acts on the salt." In proving this law experimentally, Berthelot measures cells constructed as follows:

1. Pt | $HNO_3$ | NaOH | Pt.
2. Pt | $HNO_3$ | $NaNO_3$ | Pt.
3. Pt | $NaNO_3$ | NaOH | Pt.

Though the platinum electrodes were not saturated with hydrogen or oxygen, these cells are hydrogen concentration cells, in which the concentrations of the hydrogen on the electrodes are not constant, on account of the fact that the electrodes did not have hydrogen or oxygen bubbling over them. Berthelot thought he was measuring the electromotive forces at the liquid-liquid junction exclusively, while of course the actual electromotive force is made up of that of the liquid-liquid junction and of the two metal-liquid junctions. The author of the present paper denies the existence of any electromotive force at the liquid-liquid junction at all, and proposes another law as a substitute for Berthelot's, which is entirely incorrect and is therefore not reproduced here. M. DeKay Thompson, Jr.

**Theoretical Properties of Free Ions in Solutions.** By E. F. Roeber. *Trans. Am. Electrochem. Soc.*, 4, 159.—This paper is a discussion of the electrolytic dissociation theory.

M. DeKay Thompson, Jr.

**Present Status of the Electrolytic Dissociation Theory.** By Wilder D. Bancroft. *Trans. Am. Electrochem. Soc.*, 4, 175.—The advantages and the limitations of this theory are here pointed out. M. DeKay Thompson, Jr.

**The Continuous Advance of Electrochemistry.** By Joseph W. Richards. *Trans. Am. Electrochem. Soc.*, 5, 37.—The presidential address at the fifth general meeting of the American Electrochemical Society. Attention is called to problems of the

immediate future; the author then states his views on the electrolytic dissociation theory, and passes on to a discussion of industrial electrochemistry. M. DEKAY THOMPSON, JR.

**The Electrochemical Laboratory of the Massachusetts Institute of Technology.** BY H. M. GOODWIN. *Electrochem. Industry*, **2**, 264.—A detailed, illustrated description of the electrochemical laboratory at the Massachusetts Institute of Technology, which was equipped in 1903. M. DEKAY THOMPSON, JR.

**The Standard Cell.** BY FRANK A. WOLFF, JR. *Trans. Am. Electrochem. Soc.*, **5**, 49.—In the three fundamental units of current, electromotive force and resistance, two only need to be defined concretely, as the third is determined by Ohm's Law. The author enumerates the advantages of defining electromotive force concretely, over that of current. The advantages of the Weston cell over the Clark are pointed out. An apparatus for preparing mercurous sulphate electrolytically is described.
M. DEKAY THOMPSON, JR.

**Preparation of Materials for Standard Cells and their Construction.** BY HENRY S. CARHART AND GEORGE A. HULETT. *Trans. Am. Electrochem. Soc.*, **5**, 59.—The authors find that mercurous sulphate prepared electrolytically gives more constant values of electromotive force than when prepared by precipitation of the nitrate with sulphuric acid. The sulphate is obtained free from nitrate, and the cells made with this preparation reach their equilibrium immediately. An apparatus for preparing mercurous sulphate electrolytically is described.
M. DEKAY THOMPSON, JR.

**Single Potential of the Halogen Elements.** BY WILLIAM ROY MOTT *Trans. Am. Electrochem. Soc.*, **5**, 73.—The single potentials of the halogens are computed from the heats of formation of a halogen salt and the single potential of the metal in the salt, as determined by Neumann. The average is then taken of the values thus obtained from different salts of the same halogen. These are called the calcülated values. The single potential of fluorine is then found to be —2.53 volt by polarizing a small anode and discharging. From the decomposition points of potassium fluoride, —2.65 is obtained for the potential of fluorine. For chlorine the discharge potential gave —1.81 volt. The decomposition point for potassium bromide gave —1.40 as the single potential of bromine. Similarly for iodine —0.91 was obtained. Tabulated, these results are:

| | Calculated. | Observed. |
|---|---|---|
| Fluorine | —2.57 | —2.65<br>—2.53 |
| Chlorine | —2.00 | —1.81 |
| Bromine | —1.53 | —1.40<br>—1.43 |
| Iodine | —0.87 | —0.91 |

The only difference between these two sets of values is that each calculated value is obtained by computing the decomposition values from thermochemical data and using the single potential of several metals determined by Neumann, while the figures in the second column are from observed decomposition points and the single potential of the single metal potassium, measured by Patten and Mott (*Electrochem. Ind.*, 1, 450). A table is computed of the decomposition voltages of a large number of halogen salts and the results plotted. A table of the heats of solution in terms of volts is also calculated, from which the author draws some general conclusions. M. DEKAY THOMPSON, JR.

**The Composition and Resolution of Voltages.** BY JOSEPH W. RICHARDS. *Trans. Am. Electrochem. Soc.*, 5, 89.—By "voltage" the author means "energy," as he states at the end of the paper. He computes that a certain amount of voltage is gained by the impurities of zinc, iron and nickel in a copper anode in a copper refining bath, apparently forgetting that this energy would be used up in local action. Zinc impurity in the anode would dissolve and precipitate an equivalent amount of copper on the *anode*, not on the cathode. M. DEKAY THOMPSON, JR.

**The Energy of Ions.** BY LOUIS A. PARSONS. *Trans. Am. Electrochem. Soc.*, 5, 131.—A reply to some remarks of C. J. Reed on the ionic theory. M. DEKAY THOMPSON, JR.

**The Aluminum Condenser.** BY C. I. ZIMMERMAN *Trans. Am. Electrochem. Soc.*, 5, 147.—The film coating the aluminum electrodes is estimated from interference color phenomena to vary from less than 0.000005 cm. to more than 0.000050 cm. The film is an asymmetrical dielectric as well as an asymmetrical conductor. A condenser consisting of two aluminum plates holds a constant coulomb charge when operating in an alternating current circuit, which sets up a uniform pressure between the electrolyte and a point in the metallic circuit which is neutral to the alternating pressure. The ordinary condenser behavior upon alternating current circuits is possessed by the aluminum condenser. The losses are due to the film, $C^2R$, and decomposition. M. DEKAY THOMPSON, JR.

**Dimensions of the Films on Aluminium Anodes.** BY WILLIAM ROY MOTT. *Electrochem. Industry*, 2, 268.—The author finds that anodes of aluminium in a saturated acid sodium phosphate solution gain in weight. Before weighing, the plates were washed in distilled water and dried. Whether the liquid-air-anode junction is small or large has no effect on this gain. Formation of the film is accompanied by more or less corrosion. It was found the greater the voltage, the greater the gain in weight up to 60 volts, when the rate of corrosion balances the rate of gain

due to the increase in thickness of film. The specific gravity of the film is assumed to be 2, and this is made the basis of a calculation of the thickness. Values thus computed are:

| Voltage. | Thickness in cm. |
|---|---|
| 20 | 0.000014 |
| 40 | 0.000037 |
| 60 | 0.000038 |

The thickness is also calculated from the number of coulombs required for the formation, first, on the assumption that the film is $Al(OH)_3$ and second, that it is $AlPO_4$. These values are:

| | Thickness in cm. | |
|---|---|---|
| Voltage. | $Al(OH)_3$. | $AlPO_4$. |
| 10 | 0.000013 | 0.000025 |
| 50 | 0.000032 | 0.000063 |
| 120 | 0.000064 | 0.0000126 |

The values obtained by means of interference colors were:

| Voltage. | Thickness in cm. |
|---|---|
| 25 | 0.00002 |
| 100 | 0.00008 |

Films were removed by electrolyzing the plate as anode in a copper sulphate solution. The thickness was measured by a direct-vision spectroscope and found to be "0.0007 cm. or less." The method of measurement is not explained. This film was formed at 125 volts. The electrolyte is of influence on the thickness of the films. Sulphates give the thickest, citric acid the thinnest film. The author concludes that the film is roughly a linear function of the voltage, and gives the following table for the film in a phosphate solution.

| Voltage. | Thickness in cm. |
|---|---|
| 1 | 0.000001 |
| 20 | 0.00002 |
| 80 | 0.00008 |
| 320 | 0.0003 |

M. DEKAY THOMPSON, JR.

**The Electrical Properties of the Films that Form on Aluminum Anodes.** BY WILLIAM ROY MOTT. *Electrochem. Industry*, **2**, 352.—This paper treats of the specific resistance, insulating strength and specific inductive capacity of films that form on aluminum anodes. The concentration of the electrolyte and the size of the electrode have little effect on the specific resistance, while the temperature, purity of electrolyte and the effect of incomplete formation are of great importance. The specific resistance in a 0.1 normal solution of $Na_2HPO_4$ at 25° was found to be $10^{11}$ ohms. The same quantity, calculated from observations of Cook in an alum solution, gave $0.8 \times 10^{10}$ ohms. The specific resistance decreases as a logarithmic function of the temperature,

from which the critical voltage and current are defined as the voltage and current at which the heating effect just balances the cooling effect. The dielectric strength of films formed in a phosphate solution is calculated to be 1,000,000 volts per centimeter. The specific inductive capacity has not been measured accurately, but 10 is considered the best value to assume at present. M. DEKAY THOMPSON, JR.

**Colloidal Precipitation upon Aluminium Anodes.** BY WILLIAM ROY MOTT. *Electrochem. Industry*, **2**, 444.—The similarity between absorption in the case of colloidal precipitation and of the formation of films on aluminium anodes is shown. The explanation of the formation of films is that first aluminium hydroxide is formed, which then adsorbs the acid radical and forms a hard, dense insoluble solid. M. DEKAY THOMPSON, JR.

**A Contribution to the Study of the Electric Arc.** BY WILLIAM S. WEEDON. *Trans. Am. Electrochem. Soc.*, **5**, 171.—The losses in weight of the cathode and anode in the electric arc were measured, to see whether they follow Faraday's Law. Only direct currents were used. Arcs of copper terminals in air, and in hydrogen, the iron arc in hydrogen, and the carbon arc in hydrogen were tested. No connection with Faraday's Law was observed. Some interesting properties of arcs are described.
M. DEKAY THOMPSON, JR.

**Some Phenomena Observed in Connection with the Use of a Copper Voltameter.** BY ISAAC ADAMS AND BARRY MCNUTT. *Trans. Am. Electrochem. Soc.*, **5**, 191.—The phenomena referred to are that on closing a circuit containing the voltameter, the polarization of the voltameter was found to decrease at first and then increase, and that copper dissolves in the cupric sulphate solution, which, however, is not new (see Foerster and Seidel, *Z. anorg. Chem.*, **14**, 106). M. DEKAY THOMPSON, JR.

**Thermoelectric Determination of the Reduction Temperature of Zinc Oxide.** BY WOOLSEY MCA. JOHNSON. *Trans. Am. Electrochem. Soc.*, **5**, 211.—The author determines the temperature at which zinc oxide is reduced by different kinds of carbon.
M. DEKAY THOMPSON, JR.

**A Contribution to the Theory of the Jungner-Edison Accumulator with Constant Electrolyte.** BY M. U. SCHOOP. *Electrochem. Industry*, **2**, 272 and 310.—The author weighs the electrodes suspended in the electrolyte, and determines the change in weight during discharge. Electrodes were taken from an old Jungner accumulator. The change in weight observed is due to oxidation or reduction, to the change in volume of the electrode, and to the change of weight of liquid in the pores of the active material. A formula is deduced which takes these

changes into account. On discharging an iron electrode, the increase in weight observed was greater than 0.3 gram per ampere hour, which would be the amount due to oxidation. As the discharge was slow, the concentration change in the pores was assumed to have time to be equalized and this excess is due to the contraction of the plate. On discharging with 15 amperes, the concentration changes do not have time to disappear, so that on stopping the current the iron plates continued to increase in weight. This proves that on discharge the electrolyte becomes dilute in the pores of the iron plate. The final value attained agrees well with that found with low current density. Similar results were found for the cadmium electrode. The change in volume of the nickel electrode on the passage of the current is greater than for the iron or cadmium. On discharge, the nickel electrode loses 0.3 gram per ampere hour. When weighed in the electrolyte it was found to increase in weight on discharge. This is due to the specific gravity of the active material increasing on discharging. Attempts to determine change in weight of active material by removing from the electrolyte and weighing gave unsatisfactory results. M. DEKAY THOMPSON, JR.

**The Rapid Measurement of the Conductivity of Copper Electrolytes.** BY LAWRENCE ADDICKS. *Electrochem. Industry*, **2**, 306. —The method here described consists in sending a current through a liquid column of known dimensions, and measuring, with a voltmeter, the drop in potential through a given length of the column. Two extra electrodes are required for the voltmeter circuit. These must not be near the electrodes carrying the main current. A glass tube 5 cm. in diameter and 55 cm. long, with the potential electrodes 25 cm. apart, gave values of current and voltage that could be read with sufficient accuracy. The method is accurate to about 2 per cent.

M. DEKAY THOMPSON, JR.

**Some First Principles of Electrical Resistance Furnaces.** BY F. A. J. FITZGERALD. *Electrochem. Industry*, **2**, 342.—Two kinds of resistance furnaces are considered, those with a central core carrying the current, and surrounded by the material to be heated, and those in which the substance to be heated carries the current itself. Formulae are deduced for computing the proper dimensions of the cores of large furnaces from experiments on a small scale, so that the same effect will be obtained with the large as with the small core. Attention is called to the importance of good heat insulation, and to having the furnace built so as to have a minimum surface for a given volume. The author states that owing to a lack of knowledge of the specific heats of substances at high temperatures, of the temperatures attained in ovens, and of the heats of reactions, calculations of absolute efficiency have little value. The relative efficiency of different

forms of furnaces may be determined by measuring their output and the energy consumed, where the product is the same.

M. DEKAY THOMPSON, JR.

**Differences in the Electrolysis of Potassium Chloride and Sodium Chloride.** BY F. WINTELER. *Electrochem. Industry*, **2**, 391.—Though at first glance there should appear to be no difference in the electrolysis of potassium and of sodium chloride, the author shows that when electrolyzed on a commercial scale there are certain differences. These are caused by the different degrees of purity in which the two are obtained in the market, and by the difference in the solubility of the chlorides and chlorates. The magnesia, present as impurity in sodium chloride, would clog a diaphragm, so that a diaphragm cell is not suitable for the electrolysis of salt. The impurity in potassium chloride is mostly moisture and iron oxide, and would have no injurious effect on a diaphragm.

M. DEKAY THOMPSON, JR.

**Electrolytic Calcium.** BY JOSEPH H. GOODWIN. *Proc. Am. Phil. Soc.*, **43**, 381.—A method for producing calcium from melted calcium chloride is described, the principle of which is identical with that patented by Suter and Redlich (see *Jahrb. d. Elek.*, **10**, 657). This consists in allowing the cathode just to touch the surface of the melted electrolyte, and to withdraw it slowly as the calcium is deposited, thus forming a rod of the metal. The author obtains a current efficiency of 26.6 per cent. The product was 98 per cent. pure. The specific gravity was found to be 1.54 at 29.2°. The conductivity and tensile strength were also measured.

M. DEKAY THOMPSON, JR.

**The Electrolysis of Water.** (Paper II.) BY JOSEPH W. RICHARDS AND WALTER S. LANDIS. *Trans. Am. Electrochem. Soc.*, **4**, 111.—Different voltages are impressed at the platinum electrodes in a capillary tube, and the resulting current observed. The electrolytes were sulphuric acid of varying strength, and sodium carbonate. The current was observed about five seconds after closing the circuit. From these data the resistance of the cell was computed and compared with the resistance as calculated from Kohlrausch's values of the specific conductivity of the electrolyte. In one case the result differs from Kohlrausch by 6 per cent. and in another it is very close. In the face of this poor agreement with Kohlrausch's values and of the large differences between the single observations of the authors themselves, this is suggested as a method of measuring specific resistance of electrolytes, evolving hydrogen and oxygen under ordinary conditions. The distribution of the voltage through the vessel is computed to determine the amount to overcome the I R drop and the polarization.

M. DEKAY THOMPSON, JR.

## MINERALOGICAL AND GEOLOGICAL CHEMISTRY.

**The Crystallization of Luzonite and Other Crystallographic Studies.** BY ALFRED J. MOSES. *Am. J. Sci.*, **20**, 277–284; figures.—The reddish bronze, fine-grained variety of $Cu_3AsS_4$ from the copper veins of Mancayan, Luzon, Philippine Islands, hitherto supposed to be dimorphous with enargite, is shown, on the strength of measurements of minute crystals, to be merely a variety of enargite. Other minerals examined and described in the paper are: Crystallized wolframite from Boulder County, Colorado; sylvanite with new faces, from Cripple Creek, Colorado; hematite from Franklin Furnace, New Jersey, with a marked rhombohedral parting, having almost exactly the angle of the unit rhombohedron of calcite. W. F. HILLEBRAND.

**The Determination of the Optical Character of Birefracting Minerals.** BY FRED. EUGENE WRIGHT. *Am. J. Sci.*, **20**, 285–296; figures.—The usual methods for the determination of the optical character of minerals have a certain limitation in the case of biaxial minerals. The methods described in this paper are of general application and "are based on phenomena observed in convergent polarized light with nicols crossed."

W. F. HILLEBRAND.

**Petrography of the Tucson Mountains, Pima County, Arizona.** BY F. N. GUILD. *Am. J. Sci.*, **20**, 313–318; plate.—The rocks described, without analytical data, are: Rhyolites and rhyolitic tuff, andesites, and basalt in several varieties.

W. F. HILLEBRAND.

**Mineralogical Notes, No. II.** BY WM. P. HEADDEN. *Proc. Colorado Sci. Soc.*, **8**, 55–70.—*Columbite* from about 7 miles west of Canyon City, Colorado: $Cb_2O_5$, 56.48; $Ta_2O_5$, 22.12; $WO_3$, 0.45; $SnO_2$, 0.11; FeO, 8.07; MnO, 12.45; Ign., 0.15; total, 99.83; sp. gr., 5.66 at 20°. *Columbite* from the Black Hills, South Dakota: $Cb_2O_5$, 54.64; $Ta_2O_5$, 25.62; $SnO_2$, 0.15; FeO, 6.80; MnO, 12.61; total, 99.82; sp. gr., 5.90 at 24°. *Fibroferrite*, 30 miles southwest from Green River, Utah; $Fe_2O_3$, 30.22; $SO_3$, 31.57; $H_2O$, 37.06; $Na_2O$, 0.59; insol., 0.10; traces CaO, MgO; no $K_2O$; total, 99.54. The material was not quite pure. Neglecting a slight excess of water, the analysis leads to the formula $Fe_2O_3,2SO_3,10H_2O$. *Enargite*, Prowers Mine, Gilpin County, Colorado: Cu, 48.40; Pb, 1.83; Fe, 0.30; Zn, 0.19; As, 16.17; Sb, 3.77; S, 29.35; total, 100.01; sp. gr., 4.42 at 18°. *Alunogen*, Doughty Springs, Delta County, Colorado. Analyses are given of massive, micaceous and fibrous forms of a hydrous sulphate of aluminum in which appreciable percentages of magnesium sometimes occur, thus ranging toward pickeringite. *Doughtyite* is the provisional

name given to a hydrated basic aluminum sulphate now forming by union of waters from two of the Doughty group of springs, in Delta County, Colorado (see this Journal, **27**, R 213), and affording the formula $Al_2(SO_4)_3,5Al_2(OH)_6,21H_2O$. *Bismuthinite* from the Paulina mine, Nacozari, Mexico. Deducting a considerable amount of impurity the ratio of bismuth to sulphur is very close to the theoretical. Sp. gr. corrected for foreign matter, 6.91. There is also an analysis of a black and soft material, resembling wad, which, however, proved to consist mainly of oxidized copper with nearly 12 per cent. of palladium and a little platinum. It is supposed to be an artificial product, perhaps from Wyoming. W. F. HILLEBRAND.

**Contributions from the Mineralogical Laboratory of the University of Wisconsin.** BY W. H. HOBBS. *Am. Geologist*, **36**, 179–186; plate, figures.—*Hübnerite*, Dragoon Summit, Arizona (S. V. Peppel, analyst): $SiO_2$, 1.10; $WO_3$, 75.10; MnO, 22.87; FeO, 0.81; total, 99.88. *Epsomite* and mixtures of epsomite with *alunogen*, from Cripple Creek District, Colorado, are represented by analyses. *Crystallized copper* in beautiful films and trees, associated with hematite, is found at the Minnesota mine, Soudan, Minnesota. Like that found by Haworth at Enid, Oklahoma, it is supposed to have been formed by reduction under the influence of oxidizing ferrous compounds. The following, some of which have received crystallographic study, are also described: Quartz crystals from Las Vegas, New Mexico; calcite, sphalerite and pyrite from Oshkosh, Wisconsin; pyrite, marcasite, sphalerite, chalcopyrite, dolomite from Eau Claire, Wisconsin; dolomite and white zinc oxide from Highland, Wisconsin; calcite, celestite, fluorite, sphalerite from the Helderberg limestone of Tiffin, Ohio; calcite from Grand Rapids, Michigan.

W. F. HILLEBRAND.

**Great Meteorite Collections; Some Words as to Their Composition as Affecting their Relative Values.** BY HENRY A. WARD. *Proc. Rochester Acad. Sci.*, **4**, 149–164; plate.

W. F. HILLEBRAND.

**The Philippine Mineral Industry in 1905.** BY H. D. MCCASKEY. Advance extract from *Mineral Resources of the U. S. Calendar Year 1904*, 13 pp.—There has been much activity in development work and prospecting, and the outlook is regarded as hopeful. W. F. HILLEBRAND.

**The Mineral Matter of the Sea, with Some Speculations as to the Changes Which Have Been Involved in its Production.** BY ROLLIN D. SALISBURY. *J. Geol.*, **12**, 469–484.—By several lines of calculation the conclusion is reached that, during the course of the earth's history, there may have been removed to

the sea an amount of rock between 3 and 21 times as much as is now above sea-level. Because of the uncertain nature of the data the truth may, however, lie outside of either of these extremes. "It is, of course, not to be inferred that the continents were ever large enough to include all the material which was worn away from them, in addition to that which they now contain....As their masses were reduced by erosion, they were renewed, either (1) by the sinking of the sea bottom....or (2) by the rise of the continental areas." The calculations seem to the reviewer defective, since they take no account of the origin of the chlorine of the sea, while the sodium in combination with it is used as one of the bases of calculation.

W. F. HILLEBRAND.

**The Classification of Igneous Intrusive Bodies.** BY REGINALD A. DALY. *J. Geol.*, **12**, 485–508; figures.—The need for a fuller classification than now exists having been declared, the author reviews former classifications, defines certain terms more precisely, and proposes a system of his own.

W. F. HILLEBRAND.

**Glauconite.** BY J. K. PRATHER. *J. Geol.*, **12**, 509–513; plate. —The results of microscopical examination of glauconite from the Greensands of New Jersey are reported. The evidence seems to be rather opposed to the view that the glauconite grains were first contained in the shells of foraminifera, which were afterwards dissolved by the action of sea-water.

W. F. HILLEBRAND.

**Black Sands of the Placer Mines of the United States.** BY DAVID T. DAY. Advance extract from *Mineral Resources of the U. S. Calendar Year 1904*, 15 pp.—This report presents the results thus far obtained in an investigation specially authorized by Congress. Letters were sent to 8000 placer miners, asking that samples of their heavy sands be furnished for examination. Over 800 samples were received from United States territory, British Columbia, Central America and Mexico. Of those received, 195 were assayed for gold and platinum. Platinum was found in 72 of them, as shown by a tabulated list. Very many sands have also been examined for other minerals, and those found are reported in another list. Columbite, tantalite and other tantalum minerals were found in sands from Nez Perces County, Idaho. Concentration experiments on some of the sands have been carried out in a specially arranged laboratory at the Lewis and Clark Exposition, Portland, Oregon. The methods of concentration and results obtained are briefly set forth.

W. F. HILLEBRAND.

**Summary Report of the Geological Survey Department of**

**Canada for the Calendar Year 1903.** BY ROBERT BELL. **Summary Report of the Geological Survey Department of Canada for the Calendar Year 1904.** BY ROBERT BELL. These volumes, of 218 and 392 pages, respectively, contain a large number of summaries of reports by field and office members of the Canadian Survey. Maps, a few figures and occasional analyses help to illustrate the text. When the detailed reports appear in print, such as may contain matter of interest to the chemist will be specially noticed in this Review. W. F. HILLEBRAND.

**Bibliography of Canadian Geology and Palaeontology for the Year 1903.** BY H. M. AMI. *Trans. Roy. Soc. Canada*, Second Series, **10**, 207–219. W. F. HILLEBRAND.

**Underground Waters of Salt River Valley, Arizona.** BY W. T. LEE. *U. S. Geol. Survey, Water Supply and Irrigation Paper No. 136*, 196 pp.; maps, plates, figures.—The character of the river and underground waters throughout this region is illustrated by very many partial analyses, made mostly in the laboratory of the Arizona Experiment Station at Tucson.

W. F. HILLEBRAND.

**Observations on the Ground Waters of Rio Grande Valley.** BY CHARLES S. SLICHTER. *U. S. Geol. Survey, Water Supply and Irrigation Paper No. 141*, 83 pp.; plates, figures.—The paper closes with an appendix containing analyses of well waters and data concerning wells at and near El Paso, Texas.

W. F. HILLEBRAND.

**Contributions to the Hydrology of Eastern United States, 1905.** BY MYRON L. FULLER. *U. S. Geol. Survey, Water Supply and Irrigation Paper No. 145*, 220 pp.; maps, plates, figures.—This, the third of a series of progress reports on the above subject (see this Journal, **26**, R 475, **27**, R 324) embraces twenty contributions by fourteen geologists. These are mainly concise summaries covering a wide range of subjects. Special artesian problems, water resources, descriptions of localities, water supplies of special types of deposits, and descriptions of important springs. In some of them appear chemical data which are in part new.

W. F. HILLEBRAND.

**Mineral Resources of the Elder's Ridge Quadrangle, Pennsylvania.** BY RALPH W. STONE. *U. S. Geol. Survey, Bull. No. 266*, 86 pp.; map, plates.—The limits of the quadrangle are latitudes 40° 30′ and 40° 45′ and longitudes 75° 15′ and 75° 30′. The chief mineral resources are coal and gas, the minor ones limestone, sandstone, clays and shales. The geology of the region is described in detail. Of the analyses quoted, some of those of coal by chemists of the survey are recent.

W. F. HILLEBRAND.

**Asphalt in the Indian Territory.** By W. R. Crane. *Eng. Min. J.*, 80, 442–443; figure.—The types of asphaltic compounds occurring are the so-called natural or bituminous rock asphalt and the several varieties of albertite. These last occur as a solid filling of steeply pitching fissure veins, which seldom extend more than 150 feet in depth, while the former permeates stratified formations in the liquid or semi-liquid state. The distribution, mining, output, refining and probable origin of these substances are very briefly discussed. The rock asphalts are regarded as the dried out residues of pools of petroleum oil that have been brought near the surface by erosion, the albertites as similar residues of oil that was once pressed up from deep-seated pools. W. F. Hillebrand.

**Piedmont District of Pennsylvania.** By F. Bascom. *Bull. Geol. Soc. Am.*, Vol. 16, pp. 289–328; plates.—This is a careful study of a region of long and most varied geologic and physiographic history. The copious chemical data that appear are mostly, if not altogether, taken from prior publications of the author and others. W. F. Hillebrand.

**Geology of the Tonopah Mining District, Nevada.** By J. E. Spurr. *U. S. Geol. Survey, Professional Paper No. 42*, 295 pp.; maps, plates, figures.—The rocks of the district are of immediate volcanic origin and the chief ore-bearing veins are in an andesite formed by the earliest eruptions. The veins are due in the main to replacement, the metals having been carried by hot ascending volcanic waters following the andesite eruption. The primary ores, analyzed by Dr. W. F. Hillebrand, have a gangue of quartz, adularia, some sericite, and carbonates of calcium, magnesium, iron and manganese; they contain silver sulphides—such as argentite, polybasite, stephanite—silver selenide, gold in a curious black alloy rich in silver, chalcopyrite, pyrite, and some galena and blende. Some 2.5 per cent. of selenium is present, without its usual associate, tellurium. In the zone of oxidation, a comparison of analyses shows no important change in the amount of gold and silver. Argentite remains largely unaltered, polybasite and stephanite and much of the silver selenide have been attacked. The silver is in part reprecipitated at once as secondary argentite, while a large portion is changed by the chlorine of the surface waters to chloride. Bromide and iodide are also present. Most of the arsenic and antimony has been dissolved; the rest forms secondary pyrargyrite. Pyrite and chalcopyrite are attacked and carried off. The so-called oxidized ore is thus really only a modified ore. The original must be consulted for outlines of the chemical methods which led to the recognition of the mineral composition of these complex ores. As to reprecipitation lower down of oxidized and dissolved material, there is little light.

Plainly secondary sulphides in the sulphide zone are argentite and pyrargyrite, with probably chalcopyrite. These, however, may have been derived from the same primary ore by lateral secretion. Secondary blende or galena was not observed. The earlier hornblende-biotite andesite, which carries the ore, is much altered, especially in the veins, where it has been almost entirely replaced by quartz. This metalliferous quartz represents the extreme result of one form of alteration, that into quartz, sericite and adularia, a phase which grades into a second principal transformation of the andesite into chlorite and calcite, which takes place only remote from the veins. The mineralization and alterations are the work of the same waters, which within the main circulation channels deposited silica, potash and the rich sulphides, and in exchange dissolved from the rock soda and magnesia completely and lime and iron partially. As the waters penetrated the andesite away from the channels the composition of the solution was thus changed, and first the deposition of the metals and then that of potash and silica ceased, and finally the chlorite-calcite alteration became the result of their action. The abundance of carbonates and sulphides is evidence that the water at this point contained hydrogen sulphide and carbon dioxide. Analyses of the vein rock in the various stages of decomposition show the progressive loss in soda, magnesia, lime and iron and gain in potash and silica. The calcite-chlorite alteration, on the other hand, appears to have been effected without appreciable loss or gain of the bases. Eruptions succeeding the andesite resulted in rhyolites and dacites, which carry low-grade or barren veins, and occasionally in basalts. The hypothesis is reached "that an original magma of composition similar to that of the earlier andesite has split up by differentiation first into a more basic andesite (later andesite) and a silicious dacite, and later, by continuation of the process, into a silicious rhyolite and a basalt." Hornblende was a first crystallization in both what are now acid and basic rocks; in both it has undergone transformation as a result of changing magmatic composition—in the rhyolite to biotite, in the basalt to augite. The relation between adularia and muscovite as decomposition products is discussed; the formation of the latter may depend on the presence of fluorine. The probable origin of albite and orthoclase as vein minerals is considered. Attention is drawn to the antithesis between the composition of the lavas and the contents of the waters which followed them. The eruption of the earlier andesite, for instance, a rock of intermediate composition containing about five times as much soda, lime, iron, and magnesia as it does potash, seems to have been followed by waters rich in the elements characteristic of extremely acid rocks, *viz.*, silica and potash. The paper contains analyses by the Survey chemists of rocks and ores in various stages of alteration. E. C. SULLIVAN.

## ANALYTICAL CHEMISTRY.

**Uniformity in Technical Analysis.** By W. C. Ebaugh. *Eng. Min. J.*, 80, 434.—After some discussion of the causes leading to non-agreement among analysts, and of the steps hitherto taken by various organizations to bring about a better condition, the author speaks of the work now in progress by a committee appointed by The Western Association of Technical Chemists and Metallurgists. The members of the committee are: Hermann Fleck, Colorado School of Mines, W. C. Ebaugh, University of Utah State School of Mines, and J. G. Lang, Greenwood, B. C. The duty of the committee is to study the analytical methods used in metallurgical works of the West, and it has begun its labors by preparing a standard sample of a sulphide ore, which is to be tested as to its several constituents both by methods recommended by the committee and by those in ordinary use by the chemists coöperating. It is desired that all who can will make the analyses with a view to eventually lessening the number of disputes and developing a greater degree of confidence than now obtains in the results of mine and smelter chemists. Editorial comment is made upon the paper of Prof. Ebaugh and on the general subject of uniformity in technical analysis in the same number of the *Engineering and Mining Journal* (p. 451) and again two weeks later (p. 545). In full sympathy with the idea of bringing about greater uniformity, the editor yet thinks the method commonly employed of sending out a limited number of samples to many chemists is unphilosophical. Many samples should be sent to but few chemists. The universities and technical schools are to some extent blameworthy for not recognizing that technology must have quick methods and that in their laboratories can best be done what the committees of technical societies have tried to do. The matter is of such importance that the whole subject ought to be taken up broadly by some international society, *e. g.*, the Society of Chemical Industry. W. F. Hillebrand.

**Labor-saving Appliances in Baltimore Laboratory of the Anaconda Copper Refining Company.** By Dr. E. Keller. *Electrochem. and Met. Industry*, 3, 9, 329 (Sept., 1905).—In a paper read by the author before the American Institute of Mining Engineers, he shows the advantages of substituting machinery for manual labor in a modern technical laboratory. The general arrangement of the laboratory of the Anaconda Company at Baltimore is given and special mention is made of the method of ventilation. Several examples of labor-saving appliances are described in detail, with illustrations. By one device solutions in ten beakers arranged on a long rack or tray are stirred simultaneously, the individual stirrers being attached to a general

driving gear. By means of a similar tray or rack, solutions in twenty beakers are filtered at the same time, pouring being done by a simple movement of the hand. These appliances save time, increase the amount of work that can be done by one man, and tend to do away with the irresponsible "laboratory boy."

FRANCIS C. KRAUSKOPF.

**Tin in Alaska.** BY MARTIN SCHWITTER. *J. Soc. Chem. Ind.*, 24, 12 (June 30, 1905).—Tin was discovered in 1901 on Cape Mountain at the extreme western end of Seward Peninsula, Alaska. The country is mountainous, unsettled, and shut off from supplies from November to June. The tin occurs as cassiterite, sometimes alone in large crystals, and at other times mixed with granite of various kinds. The cyanide assay is used for determining the tin. From 25 to 100 grams of finely powdered sample are concentrated by panning with water. The concentrates are then treated with aqua regia, and washed with water and ammonia to remove other heavy minerals (usually iron ores and wolframite). The residual concentrates may be roughly estimated to contain about 70 per cent. of tin, but for an accurate determination these concentrates are reduced with about five times their weight of potassium cyanide. Tin that is practically pure separates on the bottom of the crucible, the reaction being $SnO_2 + 2KCN = 2KCNO + Sn$.

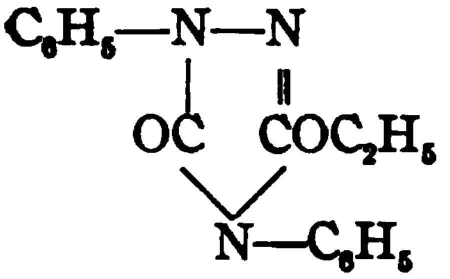
FRANCIS C. KRAUSKOPF.

**Valuation of Tannic Acid from the Point of View of the Dyer and Calico Printer.** BY W. S. WILLIAMS. *J. Soc. Chem. Ind.*, 24, 877.—The author enumerates the tannin materials in use at the present time and gives the impurities found in them. A method for sampling is given. In accurate work, the moisture must be determined by drying in a vacuum, over sulphuric acid. The simpler method is to dry the sample for two hours at 95° C. The dried tannin should not be used for subsequent analyses. A quick test for resinous and tarry matter consists in boiling the sample with an equal weight of acetic acid. If the impurities mentioned are present in any quantity, a thick, sticky mass collects on the top of the solution after it is cold. A review of the literature upon the analysis of tannins is given, and a method described for the separation of non-tannins like gallic acid. For a quick comparison of tannins, the author suggests the use of a dyeing test and describes a method for carrying this out. The error of the last method is about 5 per cent. The dyeing test, however, possesses the advantage of giving a fair idea of the mordanting value and clearness of tone of two samples of tannin.

T. G. DELBRIDGE.

## ORGANIC CHEMISTRY.

**On Some Urazole and Imidothiobiazoline Derivatives.** BY HENRY L. WHEELER AND JOANNES G. STATIROPOULOS. *Am. Chem. J.*, **34,** 117–132.



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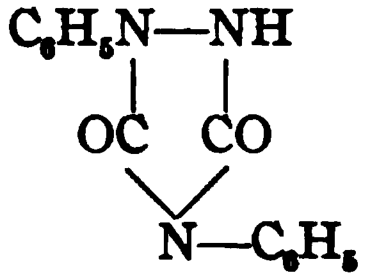

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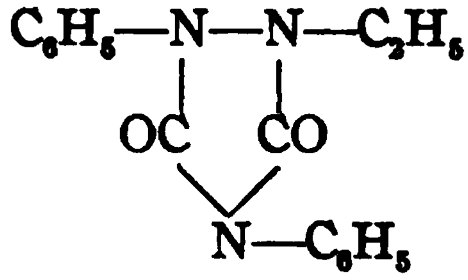

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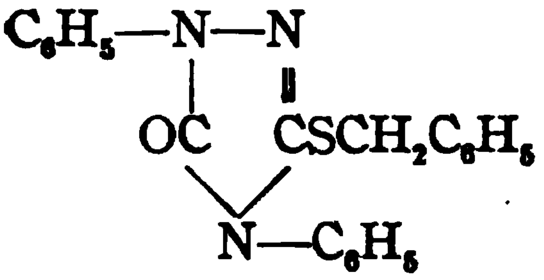

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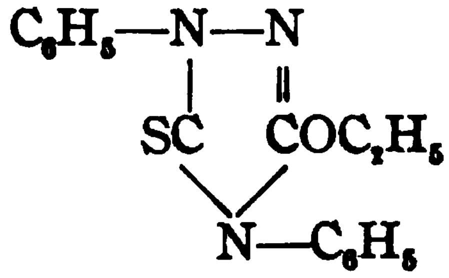

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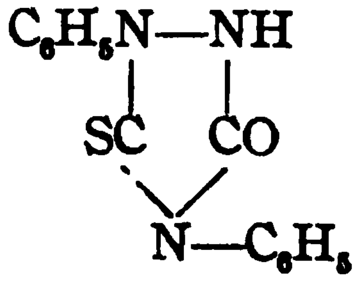

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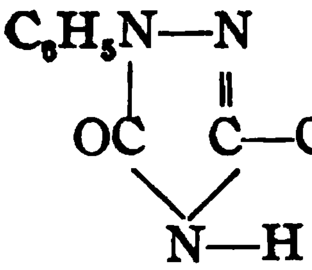

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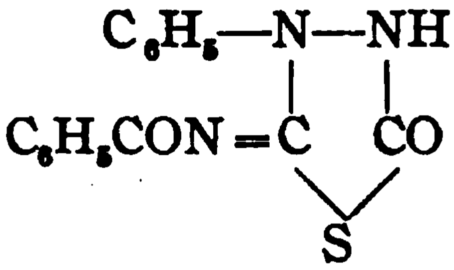

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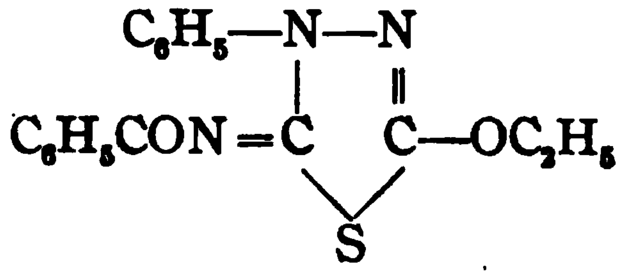

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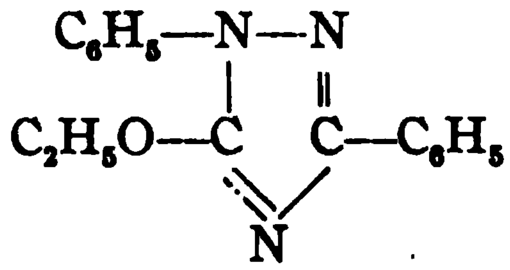

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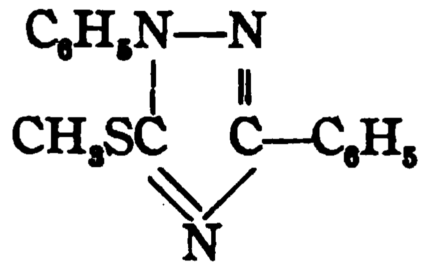

XI.

In a paper published five years ago by Wheeler and Dustin (*Am. Chem. J.*, 24, 430) on phenylthiosemicarbazidic esters, three compounds were described whose constitution was not determined. Two of these were provisionally represented as imidothiobiazolines, and the other as a urazole. Further work on the question has shown that the compounds supposed to be biazolines are really urazoles, while the one believed to be a urazole is probably an imidothiobiazoline. The first of these compounds was obtained by treating ethyl diphenylthionsemicarbazidate, $C_6H_5NHCO(C_6H_5)NNHCSOC_2H_5$, with sodium ethylate, with or without ethyl bromide, and melted at 86°. It is now shown to have the constitution represented by Formula (I) since when boiled with hydrobromic acid it gives the urazole (II). From the silver salt of the latter it may be reproduced by the action of ethyl iodide, whereas if the sodium salt is used the product is the isomeric 1,4-diphenyl-2-ethylurazole (III). The second of Wheeler

and Dustin's compounds was obtained by treating the above-mentioned ethyl diphenylthiosemicarbazidate with aqueous alkali and benzyl chloride, and melted at 110–112°. It is now shown to be the 1,4-diphenyl-3-benzylmercaptourazole (IV), since it can be synthesized from the hydrochloride of diphenylpseudobenzylthiosemicarbazide, $C_6H_5NHN{:}C(SCH_2C_6H_5)NHC_6H_5$, phosgene and alkali. When ethyl phenylthiocarbazinate, $C_6H_5NHNHCSOC_2H_5$, is treated with phenyl isothiocyanate, 1,4-diphenyl-3-ethoxy-5-thiourazole (V) results. Boiled with hydrobromic acid, the latter yields 1,4-diphenyl-5-thiourazole (VI). Both of these compounds (V and VI) are formed when isocyanphenyl chloride, $C_6H_5NCCl_2$, reacts with ethyl phenylthioncarbazinate. The third of Wheeler and Dustin's compounds was obtained by the action of benzoyl isothiocyanate, $C_6H_5CONCS$, upon ethyl thioncarbazinic ester, and melted at 138°. Boiled with hydrobromic acid, it gave 1,3-diphenyl-5-oxytriazole (VII); melted in a stream of dry hydrogen chloride, ethyl chloride was evolved and $\alpha'$-benzoylimido-$\beta'$-phenylthiobiazolone (VIII) produced, from which the original substance (m. p. 138°) was regenerated by alkylating with ethyl iodide and alkali. The substance melting at 138° is therefore believed to be $\alpha$-ethoxy-$\alpha'$-benzoylimido-$\beta'$-phenylthiobiazolone (IX), which gives the triazole (VII) by rupture of the ring and subsequent condensation. The diphenyloxytriazole (VII) was also prepared by warming acetonebenzoylphenylsemicarbazone, $(CH_3)_2C{:}NN(C_6H_5)CONHCOC_6H_5$, with a little dilute hydrochloric acid (evolution of acetone). EXPERIMENTAL.—*1,4-Diphenyl-3-ethoxyurazole* (I) was prepared from the silver salt of 1,4-diphenylurazole and ethyl iodide in the cold, and found to be identical with the compound previously described by Wheeler and Dustin as $\alpha$-ethoxy-$\alpha'$-phenylimido-$\beta'$-phenyloxybiazoline. It crystallizes from alcohol in long, slender, colorless prisms, m. p. 85–86°. Boiled with strong hydrobromic acid, it is reverted to 1,4-diphenylurazole. *1,4-Diphenyl-2-ethylurazole* (III).—When the sodium salt of 1,4-diphenylurazole was heated at 100° with ethyl bromide, the product was the 1,4-diphenyl-2-ethylurazole, which crystallizes from alcohol in colorless glistening prisms, m. p. 125–126°, and is unattacked when boiled with hydrobromic acid. *Benzyl Chloride Addition-product of Diphenylthiosemicarbazide*, $C_6H_5NHNHCCl(SCH_2C_6H_5)NHC_6H_5$.—This was produced by the interaction of diphenylthiosemicarbazide and benzyl chloride in the presence of dry benzene. It forms a white powder, m. p. 149–150°. The free pseudobenzylthiosemicarbazide is very unstable, and oxidizes rapidly in the air; in one case a few bright red needles were obtained, melting at about 55°, which were probably crystals of the azo compound, $C_6H_5N{:}NC(SCH_2C_6H_5){:}NC_6H_5$. *1,4-Diphenyl-3-benzylmercaptourazole* (IV) was obtained by treating an ether solution of the above free pseudothiocarbazide with

phosgene and alkali. It crystallizes from alcohol in fine shining needles, m. p. 110–112°, and is identical with the compound obtained by Wheeler and Dustin from ethyl *c,b*-diphenyl-$\alpha$-thionsemicarbazidate, benzyl chloride and alkali. 1,4-*Diphenyl-3-ethoxy-5-thiourazole* (V).—Ethyl phenylthioncarbazinate and phenyl isothiocyanate were heated together on the steam-bath. Hydrogen sulphide was evolved, and diphenylthiourea and 1,4-diphenyl-3-ethoxy-5-thiourazole formed. The latter forms beautiful prisms (crystallographic data are given), m. p. 83°, and yields 1,4-diphenyl-5-thiourazole (VI) when boiled with hydrobromic acid, or when dry hydrogen chloride is passed into the fused material at 85–95°. Both the thiourazole and the 3-ethoxy derivative are formed when isocyanphenyl chloride reacts with ethyl phenylthioncarbazinate. 1,3-*Diphenyl-5-oxytriazole* (VII).—The compound obtained by Wheeler and Dustin as the result of the action of benzoyl isothiocyanate upon ethyl thioncarbazinic ester, and melting at 136–138°, gave 1,3-diphenyl-5-oxytriazole when boiled with strong hydrobromic acid. This triazole crystallizes from alcohol in colorless needles, m. p. 229–230°. From acetonephenylhydrazone and benzoylisocyanate, the semicarbazone, $C_6H_5CONHCON(C_6H_5)N:C(CH_3)_2$, was prepared. It crystallizes from alcohol in colorless microscopic prisms, m. p. 139–140°. Warmed with dilute hydrochloric acid, this semicarbazone gave the above 1,3-diphenyl-5-oxytriazole. 1,3-*Diphenyl-5-ethoxytriazole* (X), from the above oxytriazole, ethyl bromide and alkali at 100°, crystallizes from dilute alcohol in shining rhombic prisms, m. p. 85–86°. $\alpha'$-Benzoylimino-$\beta'$-phenylthiobiazolone (VIII) was produced when Wheeler and Dustin's compound, m. p. 136–138°, was kept fused at 140–145° and a stream of dry hydrogen chloride passed through it, ethyl chloride being evolved during the reaction. It crystallizes from alcohol in colorless needles, m. p. 206–207°. It does not form an addition-product with ethyl iodide. A part is decomposed by boiling with strong alkali. Its *sodium salt* crystallizes from alcohol in yellow needles, decomposing at about 240°. The *silver salt* is a yellowish white amorphous solid. $\alpha$-Ethoxy-$\alpha'$-benzoylimino-$\beta'$-phenylbiazoline (IX), from the sodium or silver salt of the above biazolone and ethyl iodide, is identical with the previously mentioned compound of Wheeler and Dustin melting at 136–138°, and can also be obtained by the action of benzoyl isocyanchloride on ethyl phenylthioncarbazinate. When pure, it is colorless, and melts at 137–138°. It is not desulphurized by mercuric oxide. An alcoholic solution of silver nitrate decomposes it. 1,3-*Diphenyl-5-methylmercaptotriazole* (XI), from the sodium salt of 1,3-diphenyl-5-thiotriazole and methyl iodide, crystallizes from alcohol in large colorless needles, m. p. 56–57°. 1,3-*Diphenyl-5-ethyl-mercaptotriazole*, prepared in similar manner, using ethyl bromide instead of methyl iodide, crystallizes from

alcohol in stout, colorless prisms, m. p. 52–53°. With hydrobromic acid it gives a salt melting at 152°, which loses its hydrogen bromide when boiled. *1,3-Diphenyltriazole-5-disulphide*, $(C_{14}H_{10}N_3)_2S_2$, from the sodium salt of the thiotriazole and iodine, crystallizes from benzene in fine colorless needles, m. p. 182–183°.

M. T. BOGERT.

**The Reaction between Unsaturated Compounds and Organic Magnesium Compounds. VI. Reactions with Ethyl Benzalmalonate.** BY E. P. KOHLER. *Am. Chem. J.*, **34**, 132–147.—The first reaction between ethyl benzalmalonate and Grignard's reagent consists in direct addition, giving a compound of the formula $C_6H_5(R)CH.C(COOC_2H_5):C(OMgBr)OC_2H_5$, which reacts with diphenylbrommethane to give $C_6H_5(R)CH.C(CO.OC_2H_5):C(OCH(C_6H_5)_2)OC_2H_5$ and $MgBr_2$. Both the magnesium compound and its O-alkyl derivative are very inert, the carbethoxy group not reacting with Grignard's reagent, and being very difficult to saponify. The reaction described can be used for preparing substituted malonic acids, and also for $\alpha,\beta$-unsaturated acids. EXPERIMENTAL.—The reaction between ethyl benzalmalonate and organic magnesium compounds is not affected by the relative amounts of the substances or by the conditions under which they are brought together. In most of the experiments, an ether solution of one molecule of the ester was added gradually to a solution of one molecule of the magnesium compound cooled in ice water. The resulting liquid was boiled for half an hour, and then treated with the various reagents used. The magnesium derivative itself was not isolated. *Ethyl diphenylmethylmalonate*, $(C_6H_5)_2CHCH(COOC_2H_5)_2$, crystallizes from low-boiling ligroin in fine needles, m. p. 63°. Its *sodium derivative*, $(C_6H_5)_2CHC(COOC_2H_5):C(ONa)OC_2H_5$, was prepared by treating the ether solution with sodium. Evaporation of the ether in dry air leaves the sodium derivative in small white needles. *Monoethyl diphenylmethylmalonate*, $(C_6H_5)_2CHCH(COOH)COOC_2H_5$, from the neutral ester and one molecule of alcoholic caustic potash, crystallizes from alcohol in thick needles, m. p. 165–166°, which lose carbon dioxide above 220°. The potassium salt forms fine white needles. *Diphenylmethylmalonic acid* crystallizes from water in thin plates, from alcohol in needles. It melts with decomposition at 190–192°. In boiling water it slowly loses carbon dioxide and passes into $\beta,\beta$-diphenylpropionic acid. Its *potassium salt* forms long colorless needles. *Ethyl bromdiphenylmethylmalonate*, $(C_6H_5)_2CHCBr(COOC_2H_5)_2$, prepared by the action of dry bromine upon an ether solution of the magnesium derivative obtained by the interaction of magnesium, brombenzene and ethyl benzalmalonate, and followed by the usual treatment with ice water, and so forth, crystallizes from alcohol in large diamond-shaped plates, m. p. 79–80°. *α-Brom-*

*β,β-diphenylpropionic acid*, $(C_6H_5)_2CHCHBrCOOH$, was obtained from its potassium salt. It is only sparingly soluble in water, its solutions finally decomposing into carbon dioxide, hydrogen bromide and stilbene. Its *potassium salt* is formed by the action of one equivalent of potassium hydroxide upon an alcoholic solution of ethyl bromdiphenylmethylmalonate at low temperature. It separates from water in colorless needles, and is very unstable. It is readily decomposed by heat or in solution, into carbon dioxide, potassium bromide and stilbene. By the action of hot alcoholic caustic potash, β-phenylcinnamic acid is produced. The latter may also be obtained by the action of hot alcoholic caustic potash upon ethyl bromdiphenylmethylmalonate. *Ethyl O-acetyldiphenylmethylmalonate*, $(C_6H_5)_2CHC(COOC_2H_5):C(OCOCH_3)OC_2H_5$, from acetyl chloride and the magnesium derivative of ethyl diphenylmethylmalonate, crystallizes from alcohol in large lustrous plates, m. p. 92°. It is easily hydrolyzed. With phenyl magnesium bromide it gives ethyl diphenylmethylmalonate and methyldiphenylcarbinol (m. p. 98°); with sodium ethylate, the sodium derivative of ethyl diphenylmethylmalonate described above. The reaction by which it is formed also produces a small amount of another *substance*, possibly a stereomer of ethyl O-acetyldiphenylmethylmalonate. The magnesium derivatives obtained from ethyl benzalmalonate do not react with the simple alkyl halides. Diphenylbrommethane reacts, however, with formation of the *compound* $(C_6H_5)_2CHC(COOC_2H_5):C(OC_2H_5)OCH(C_6H_5)_2$, which crystallizes from alcohol in plates, m. p. 132°. Heated with concentrated hydrochloric acid, it breaks down into β,β-diphenylpropionic acid and diphenylmethylethyl ether. *Ethyl β-phenylmethylmalonate*, $C_6H_5(CH_3)CHCH(COOC_2H_5)$, from methylmagnesium iodide and ethyl benzalmalonate, is a colorless liquid, b. p. 230–235° at 15 mm. *β-Phenylmethylmalonic acid* crystallizes from water in large plates, m. p. 144°, which lose carbon dioxide above 170°, and give β-phenylbutyric acid (large, lustrous prisms, m. p. 47°). Its *potassium salt* forms needles. *α-Brom-β,β-methylphenylbutyric Acid*, $C_6H_5(CH_3)CHCH_2CHBrCOOH$.—Ethyl benzalmalonate was treated with an ether solution of ethylmagnesium bromide, and the product treated with bromine, decomposed with ice water, treated with a concentrated alcoholic solution of slightly less than one equivalent of potassium hydroxide, and the aqueous solution of the potassium salt acidified with hydrobromic acid. The free acid melts at 176°, and decomposes above 190°. The *potassium salt* forms long, silky needles. Both the acid and its potassium salt decompose in aqueous solution with formation of phenylbutylene, $C_6H_5CH:CHC_2H_5$. M. T. BOGERT.

**The Acid Oxalates of Ammonium.** BY P. T. WALDEN. *Am. Chem. J.*, 34, 147–152.—The experimental method used depends

upon the principle that two simple salts with a common ion, when mixed in varying proportions and dissolved, will separate, at a fixed temperature, solid residues of varying composition and leave solutions of constant composition, except where a double salt forms, when the residue will be constant and the solution variable. Applying this method to mixtures of ammonium oxalate and oxalic acid in aqueous solution at 25°, it was found that the only acid ammonium oxalates which can exist at this temperature are $(NH_4)_2C_2O_4.3H_2C_2O_4.4H_2O$, and $(NH_4)_2C_2O_4.H_2C_2O_4.H_2O$. Of these, the former can be recrystallized from water unchanged, the latter cannot. M. T. BOGERT.

**The Acid Oxalates of Lithium, Sodium, Potassium and Caesium, and their Solubility.**—BY H. W. FOOTE AND I. A. ANDREW. *Am. Chem. J.*, **34**, 153–164.—The acid oxalates of lithium, sodium, potassium and caesium were investigated by the method referred to in the preceding review, the object being to determine all the stable acid salts capable of forming at 25°, and the solubility conditions under which they form. The results are tabulated in groups, to show (1) constant solubility and varying residue, corresponding to a mixture of salts, and (2) varying solubility and constant residue, corresponding to a pure double salt. EXPERIMENTAL.: (1) *Oxalic Acid and Lithium Oxalate.*—Only one salt was obtained, $HLiC_2O_4.H_2O$. (2) *Oxalic Acid and Sodium Oxalate.*—Only one salt was obtained, $HNaC_2O_4.H_2O$. (3) *Oxalic Acid and Potassium Oxalate.*—Three salts were obtained, $H_3K(C_2O_4)_2.2H_2O$, $HKC_2O_4$, and $H_2C_2O_4.2K_2C_2O_4.2H_2O$. The latter is new to the literature, forms only under a narrow range of conditions, and cannot be recrystallized. (4) *Oxalic Acid and Caesium Oxalate.*—Four salts were obtained, $H_3Cs(C_2O_4)_2.2H_2O$, $H_4Cs_2(C_2O_4)_3$, $HCsC_2O_4$, and $H_6Cs_8(C_2O_4)_7$. The neutral salt, $Cs_2C_2O_4.H_2O$, was prepared from the carbonate, and found to be very soluble in water at 25°. *Comparison of the Solubilities of the Acid Alkali Oxalates.*—Tables are given showing the molecules of oxalic acid and of alkali oxalate dissolved by 100 molecules of water. The solubility results are also plotted in a diagram, by examining which not only the solubility of the different salts may be ascertained but also whether they can be recrystallized from water or not. In general, the number of acid salts appears to increase with the solubility of the single oxalates.

M. T. BOGERT.

**On Certain Alleged Double Oxalates.** BY H. W. FOOTE AND I. A. ANDREW. *Am. Chem. J.*, **34**, 164–167.—By applying the method referred to in the two foregoing reviews, the authors have shown that the following double oxalates, occurring in the literature, do not exist at 25°: $KNaC_2O_4$, $NH_4KC_2O_4$, $NH_4LiC_2O_4$, $7(NH_4)_2C_2O_4.MgC_2O_4.8H_2O$, $6(NH_4)_2C_2O_4.MgC_2O_4.10H_2O$, $6(NH_4)_2$

$C_2O_4.MgC_2O_4.9H_2O$, $5(NH_4)_2C_2O_4.MgC_2O_4.8H_2O$, $13(NH_4)_2C_2O_4.5MgC_2O_4.24H_2O$, $(NH_4)_2C_2O_4.3MgC_2O_4.2H_2O$, $2(NH_4)_2C_2O_4.ZnC_2O_4.3H_2O$, $(NH_4)_2C_2O_4.ZnC_2O_4.3H_2O$, $8(NH_4)_2C_2O_4.CdC_2O_4.11H_2O$, $6(NH_4)_2C_2O_4.CdC_2O_4.9H_2O$, $4(NH_4)_2C_2O_4.CdC_2O_4.8H_2O$, $4(NH_4)_2C_2O_4.CdC_2O_4.7H_2O$. On account of the very slight solubility of magnesium, zinc and cadmium oxalates in presence of a saturated solution of ammonium oxalate, it appears improbable that any double salts of these oxalates exist at any temperature.

M. T. BOGERT.

**Some Problems in the Cellulose Field.** BY ALVIN S. WHEELER. *Chem. Engineer*, **2**, 135–141.—See this Journal, **27**, R 268.

M. T. BOGERT.

**On a New Series of Dihydroquinoxalines.** BY JOHN B. EKELEY AND ROBERT J. WELLS. *Ber.*, **38**, 2259–2264.—See this Journal, **27**, R 94.

M. T. BOGERT.

**Notes on Organic Analysis, Part IV.** BY HENRY C. SHERMAN. *School of Mines Quart.*, **26**, 346–416.—(See this Journal, **27**, R 150, 268 and 414.) This is the final instalment of Dr. Sherman's Notes. The following chapters are given: XI, Butter; XII, Soaps and Lubricants; XIII, Proteids and Cereals; and XIV, Milk.

M. T. BOGERT.

## BIOLOGICAL CHEMISTRY.

**Auscultation of the Rhythmic Sounds Produced by the Stomach and Intestines.** BY W. B. CANNON. *Am. J. Physiol.*, **14**, 339–354.—Cannon describes the rhythmic sounds produced by the stomach and intestines in normal persons, and suggests that this method may prove of value to clinicians in cases where stomach or intestinal disorders are observed.

F. P. UNDERHILL.

**The Permeability of the Membrane of the Egg of Fundulus Heteroclitus.** BY ORVILLE HARRY BROWN. *Am. J. Physiol.*, **14**, 354–359.—The membrane of the eggs of *Fundulus heteroclitus* is practically impermeable to salts and water during the first six or eight hours, that is, eggs placed in distilled water do not lose their salts during that period. The membrane becomes most permeable after about eighteen to twenty hours. The membrane is equally permeable to water and salts.

F. P. UNDERHILL.

**The Effects of Intravenous Injections of Bone Marrow Extracts upon Blood Pressure.** BY ORVILLE HARRY BROWN AND CHARLES CLAUDE GUTHRIE. *Am. J. Physiol.*, **14**, 328–339.—There is contained in the marrow of long bones a substance

which when mixed with sodium chloride solution and injected into the veins of a dog produces a fall of blood pressure. This is true of the marrow of ox and dog and probably other animals. The cause of the fall is probably chiefly a vaso-dilatation. It comes on shortly after the injection; the heart-beat during the fall is not decreased in frequency and force. The fact that a second injection does not produce as great a depression as the first is in accordance with what is known regarding the action of an extract of the pituitary body. The results also indicate that the marrow extracts which have not been heated far above body temperature contain a presser substance. The marrow extracts contain in most cases a substance which stimulates respiration. Regarding the nature of the active substance it has been shown that it is soluble in a warm salt solution and that it is not destroyed by boiling. F. P. UNDERHILL.

**Experimental Studies on the Physiology of the Molluscs (Second Paper).** BY LAFAYETTE B. MENDEL AND HAROLD C. BRADLEY. *Am. J. Physiol.*, **14**, 313–328.—The following inorganic constituents can be recognized as normal and constant constituents of the liver of *Sycotypus*: copper, zinc, iron, calcium, magnesium and phosphorus. The presence of the first two is of special interest. Copper comprises about 8 per cent. of the total ash or 1.2 per cent. of the dry tissue. Zinc comprises about 15 per cent. of the ash or 1.7 per cent. of the dry tissue. Both metals can be identified in the tissues by appropriate color reactions. Copper is found uniformly distributed in small quantities—about 0.4 per cent.—in the gland cells and connective tissue, but is present in especially high percentages in the greenish pigment cells—averaging about 3 per cent. of the dry tissue. Zinc is found especially in the gland cells, to the amount of about 2 per cent.; in a connective tissue to the extent of 1 per cent. The liver compounds are richer in these metals in certain cases than the insoluble proteid combinations formed by the precipitation of albumin with metallic salts. The copper and zinc are probably obtained from the food of the *Sycotypus*, and retained in the liver as reserve material for the processes of haemopoiesis. Both copper and zinc are present in combination in the blood, forming a respiratory proteid peculiar to this animal. F. P. UNDERHILL.

**Some Observations on the Enzyme Catalase.** BY PHILIP SHAFFER. *Am. J. Physiol.*, **14**, 299–313.—Experiments are described which it is believed confirm the idea, advanced by Liebermann, that in the action of extracts of plant and animal tissues on hydrogen peroxide, in which the peroxide is decomposed with the evolution of oxygen gas, the oxygen liberated is only in a molecular condition as distinguished from the active or

atomic oxygen which is liberated in the spontaneous decomposition of hydrogen peroxide. This explanation of the reaction produced by catalase appears to have a bearing on the properties and function of the enzyme. The conclusions are reached that catalase is not an oxidizing enzyme; and provided the assumption is accepted of the formation of hydrogen peroxide or a similar peroxide in the organism, that the physiological function of catalase is to destroy the peroxide in such a manner that the oxygen is not liberated in an active condition, and thus to protect the tissues from the injurious oxidation which the peroxide would otherwise effect. F. P. UNDERHILL.

**Studies of the Effects of Radium on Plants and Animals. I. Preliminary Notes on the Effects of Radium Rays on Plants.** BY C. STUART GAGER. *Proc. Soc. Expt. Biol. and Med.*, **2**, 86–87. —The rays of radium (bromide) act as a stimulus to plants. The early stages of seed germination are accelerated. Seeds are less sensitive to radium when dry than when soaked. The growth of plants is retarded in an atmosphere of decaying radium emanations. Experiments to obtain radiotropic response have given negative results. Alcoholic fermentation is accelerated. Chloroplasts, under the influence of the rays, change their position in the cell as when exposed to too intense light.

**II. The Action of Radium Rays on Amoeba Proteus and upon other Micro-organisms.** BY LOUIS HUSAKOF. *Proc. Soc. Expt. Biol. and Med.*, **2**, 87.—Radium has no influence upon these micro-organisms, *Amoebae, Vorticellae, Paramecia*, etc.

**III. The Effects of Intravenous Injections of Radium Bromide.** BY RUSSELL BURTON-OPITZ AND G. M. MEYER. *Proc. Soc. Expt. Biol. and Med.*, **2**, 88.—Intravenous injection of radium bromide causes gradual increase in blood-pressure followed by a fall. Respiratory effects are also seen leading to a final respiratory paralysis.

**IV. The Radio-activity of the Different Organs after Intravenous Injections of Radium Bromide.** BY GUSTAVE M. MEYER. *Proc. Soc. Expt. Biol. and Med.*, **2**, 88–89.—The following organs have been examined: liver, lungs, kidney, spleen, pancreas, brain, muscle and blood. Of these the blood showed the greatest activity, while the brain gave negative results.

**V. The Influence of Radium Bromide on Metabolism in Dogs.** BY WILLIAM N. BERG AND WILLIAM H. WALKER. *Proc. Soc. Expt. Biol. and Med.*, **2**, 89.—As a result of feeding radium bromide to dogs in nitrogenous equilibrium it was found that protein metabolism is not materially affected. The total sulphate was markedly increased. F. P. UNDERHILL.

**On Proteolytic Enzymes.** BY ARTHUR L. DEAN. *Bot. Gaz.*, **40**, 121–134.—It is shown that the proteids of the seeds of *Phase-*

*olus vulgaris* undergo proteolysis during germination as a preliminary to the transportation of the nitrogen and its utilization in the formation of new organs. While no evidence of an enzyme capable of digesting the proteids present can be found, yet an ereptase is present which is capable of digesting proteoses which are probably formed by decomposition of the protoplasm. Various hypotheses for the reason of the presence of the ereptases are discussed. F. P. UNDERHILL.

**The Influence of the External Temperature upon the Viscosity of the Blood.** BY RUSSELL BURTON-OPITZ. *Proc. Soc. Expt. Biol. and Med.*, **2**, 85.—It was proved by a series of experiments that the viscosity of the "living" blood can be greatly influenced by changing the temperature of the surrounding medium. The viscosity was found markedly increased, if the dogs used were immersed in water at 25° C. Warm water-baths (42–45° C.) produced a corresponding decrease in the viscosity. The specific gravity of the blood was changed in a corresponding manner.

F. P. UNDERHILL.

**The Changes in the Viscosity of the Blood during Narcosis.** BY RUSSELL BURTON-OPITZ. *Proc. Soc. Expt. Biol. and Med.*, **2**, 85–86.—Determinations of the viscosity of the "living" blood were made during deep and light ether and chloroform narcosis. It was found that the viscosity is increased by deep and lessened during light narcosis. The specific gravity of the blood also showed regular variations. It is increased by deep and lessened by light ether narcosis. Chloroform, on the other hand, produces a slight decrease during deep and an increase during light narcosis. Hence the specific gravity cannot be regarded as an index of the viscosity. F. P. UNDERHILL.

**Enzymes and Anti-enzymes of Inflammatory Exudates.** BY EUGENE L. OPIE. *Proc. Soc. Expt. Biol. and Med.*, **2**, 82–83.—Exudates obtained by injecting suspensions of aleuronate into the pleural cavities of dogs and rabbits were subjected to autolysis. Inflammatory exudates removed one to two days after injection of the irritant undergo very little change, while those removed three or four days after the onset of inflammation exhibit appreciable though slight autolysis. There is no relation between the degree of digestion and the number of cells present. If the cells are separated by the centrifuge from the serum and suspended in normal salt solution well-marked autolysis is demonstrable. By recombining cells and serum it can be shown that the serum inhibits this autolysis. When this inhibitory action is prevented by heating serum to 100° C., leucocytes acting upon the coagulated serum cause very active digestion. The anti-enzymotic action of the serum is unaffected by a temperature of 65° C. but is prevented at 75° C. The proteolytic ferments

of the leucocytes act both in an acid and in an alkaline medium, but are most efficient in the latter. The anti-enzymotic action of the serum is favored by an alkaline reaction, but is completely prevented in an acid medium. The serum of the exudate contains a proteolytic ferment, which is active only in an acid medium. The anti-enzymotic action exhibited by the serum of the inflammatory exudate is possessed by the serum of the blood from which it doubtless passes into the exudate.

F. P. UNDERHILL.

**On a Method of Determining Indol.** BY C. A. HERTER AND M. LOUISE FOSTER. *Proc. Soc. Expt. Biol. and Med.*, 2, 80–81.—The method described constitutes a rapid and accurate means of determining indol. It is based on the fact that indol, in slightly alkaline solution, readily condenses with sodium naphthoquinonemonosulphonate, and forms a blue compound which is only very slightly soluble in water and is readily extracted by chloroform from a watery solution or suspension. The new compound is a di-indyl naphthoquinonemonosulphonate. The solubility of this substance in chloroform is about 1 part in 4,000 of the solvent and is sufficiently great to permit a rapid and thorough extraction of the substance. Chloroform containing the di-indyl compound has a red color very similar to that of hemoglobin. Owing to this fact the compound in chloroform can be approximated colorimetrically by comparing the tint of the solution with that of the orange-red glass scale of the Fleischl hemoglobinometer. When more accurate results are desired the chloroform is evaporated and the residue of the di-indyl compound weighed. Skatol forms an homologous and similar compound with the naphthoquinone reagent, but this substance is violet rather than blue. F. P. UNDERHILL.

**On Chemical Fertilization.** BY JACQUES LOEB. *Proc. Soc. Expt. Biol. and Med.*, 2, 58–71.—As a result of a series of experiments the author considers it possible (but far from proved) that the membrane formation by the spermatozoön, and possibly the subsequent process of karyokinesis, are due to the transitory action of an acid carried by the spermatozoön into the egg or produced transitorily by the spermatozoön in the egg; and that, in addition the spermatozoön carries a second agency or substance into the egg which supplies some of the conditions produced in the author's experiments by the brief treatment with sea-water. F. P. UNDERHILL.

**On the Chemical and Physiological Properties of Ricin.** BY THOMAS B. OSBORNE AND LAFAYETTE B. MENDEL. *Proc. Soc. Expt. Biol. and Med.*, 2, 79–80; also *Am. J. Physiol.*, 14, 259–287. —See abstract this Journal, 27, R 232. F. P. UNDERHILL.

**Contributions to the Study of Sulphur. I. The Metabolism in Brombenzol Poisoning.** By W. Mackim Marriott and C. G. L. Wolf. *Proc. Soc. Expt. Biol. and Med.*, **2**, 71–73.—The experiments were undertaken with the view that brombenzene sets up a condition of cystinuria. Dogs fed on a constant diet were poisoned with brombenzene and complete analyses of the urine and feces were made. It was found that during the administration of the brombenzene the nitrogen and urea were somewhat increased. The preformed ammonia remained at a level below that of the foreperiod. The kreatinine estimations did not give results of any distinctness. The investigation of the sulphur led to the result that while the total sulphur remained unchanged there was almost complete suppression of the alkaline sulphates. The excretion of neutral sulphur, represented for the most part in this case by parabromphenylmercapturic acid, was increased 400 per cent. The ethereal sulphates rose markedly during the experiment. The chlorine and phosphorus excretion remained practically constant during the experiment. There was increased nitrogen and fat elimination in the feces. On section, the animals showed ulceration of the stomach and intestines. Microscopically, the liver and kidneys were markedly degenerated. F. P. Underhill.

**Comparative Physiological Action of Salts of Neodymium, Praeseodymium, and Lanthanum.** By B. J. Dryfuss and C. G. L. Wolf. *Proc. Soc. Expt. Biol. and Med.*, **2**, 64–65.—These experiments were carried out *in vitro* and in unicellular organisms, bacteria and infusoria, frogs, pigeons, rats and guinea-pigs. The chlorides were used, in solution isotonic with 0.6 per cent. sodium chloride. The chlorides coagulate egg and serum albumin, but neither the purified albumoses from Witte's peptone nor peptone are precipitated. Dilute solutions delay the growth of bacteria and eventually kill them. The solutions are not very toxic to spores. *Opalina*, *Paramecia*, and *Vorticellae* are killed quickly, equivalent solutions of the chlorides acting in the following order of strength, neodymium, praeseodymium, and lanthanum. In frogs, voluntary and involuntary muscles are quickly put out of action. Unicellular organisms are affected in a similar manner. Intravenous injection causes almost instant death, due to multiple embolism. Attempted chronic poisoning was unsatisfactory. The solutions were introduced both subcutaneously and intraperitoneally. Some of the animals died with ill-defined symptoms. Others remained well, except for areas of induration at the seat of injection. As all the solutions (owing to hydrolysis) are acid in reaction, the authors are inclined to attribute a large share of the acute effects to the acid present. The salts range themselves in their toxicity according to their molecular weights. F. P. Underhill.

**Further Observations upon the Phosphorized Fats in Extracts of the Kidney.** By Edward K. Dunham. *Proc. Soc. Expt. Biol. and Med.*, **2**, 63–64.—Dunham has previously shown (*Proc. Soc. Expt. Biol. and Med.*, **1**, 39) that extracts from dried kidneys obtained by the Rosenfeld alcohol-chloroform method contained from a third to two-thirds of their weights of lecithins. In the present paper the author reports that repeated extraction of the fresh, undried organ with 85 per cent. alcohol at 45° C. will accomplish the same result that may be obtained by the longer Rosenfeld method. Upon cooling, the alcoholic extracts yielded a precipitate from which a substance resembling the protagon of Liebreich could be obtained. The yield is from 0.14–0.20 per cent. of the fresh organ or 0.6–1.0 per cent. of the dried kidney. Comparison of the analyses of this substance and of protagon from brain tissue shows them to be very similar to each other. The substance from the kidney contains distinctly more nitrogen and phosphorus than that from the brain. The cleavage products show that these substances belong to the same group, for in both there could be obtained by hydrolysis with acids a reducing body, and fatty acids, phosphorus, methyl and sulphur were present. F. P. Underhill.

**A Preliminary Study of the Toxicological Action of Thorium.** By Arthur F. Chase and William J. Gies. *Proc. Soc. Expt. Biol. and Med.*, **2**, 56–57.—In frogs when less than 40 mg. of thorium tetrachloride was administered *per os* no effect was observed. Subcutaneous injection of the same quantity caused death in about sixty hours. Injection of the same amount *per rectum* appeared to be more quickly followed by toxic results than when introduced through either of the former channels. It required *per os* about 1.5 grams per kilo to produce general toxic effects, among which were anhydrosis, twitching, and progressive weakening of the muscles, with paralysis of the fore-legs preceding paralysis of the hind-legs. In fatal cases the reflexes were abolished in the usual order. The general toxic effects after introduction subcutaneously or *per rectum* were about the same as those following introduction by way of the stomach. In warm-blooded animals (mice and dogs), relatively larger doses administered subcutaneously caused restlessness, twitching of the muscles, progressive paralysis, labored breathing, stupor, death. Paralysis of the fore-legs preceded loss of power in the hind-legs. Injection of 5 grams of the chloride into a dog weighing 15 kilos failed to cause death. Ingestion of 2 grams with 100 grams of meat by a dog of 6 kilos was followed in two hours by vomiting. The ejected matter was gradually eaten during the next few hours with no other apparent effect thereafter than loss of appetite and increased desire for water. The most pronounced and con-

stant general effect of the tetrachloride of thorium was a progressive weakening of the voluntary muscles.

F. P. UNDERHILL.

**A Preliminary Communication on the Pharmacology of Thorium.** BY E. D. BROWN AND TORALD SOLLMANN. *Proc. Soc. Expt. Biol. and Med.*, 2, 55.—Thorium nitrate precipitates proteins and is intensely astringent. Its intravenous injection is promptly fatal by embolism. Applied subcutaneously, it causes local necrosis. Administered by the stomach, even large doses have no appreciable effect. Solutions in sodium citrate were found to be non-precipitant and non-astringent. As much as 1 gram of thorium nitrate, per kilo of dog, injected subcutaneously and intravenously, in citrate solution had little acute action; however, the animals appeared depressed and became emaciated. The post-mortem examination made after several weeks showed extensive and wide-spread calcification of tissues. Thorium could not be demonstrated in the calcified areas. After intravenous or subcutaneous injection, the thorium appears in the urine, and not in the feces. When administered by the mouth it appears in the feces, but not in the urine. The conclusion appears justified that absorbed thorium is excreted by the kidneys, but that the metal is neither absorbed nor excreted through the intestine.

F. P. UNDERHILL.

**The Influence of Bile upon Blood Pressure.** BY S. J. MELTZER AND WILLIAM SALANT. *Proc. Soc. Expt. Biol. and Med.*, 2, 65–66.—See this Journal, 27, R 570.

F. P. UNDERHILL.

**Experimental Measles.** BY LUDWIG HEKTORN. *Proc. Soc. Expt. Biol. and Med.*, 2, 47–51.—The results of two experiments permit the conclusion that the virus of measles is present in the blood of patients with typical measles some time at least during the first thirty hours of the eruption; furthermore, that the virus retains its virulence for at least twenty-four hours, when such blood is inoculated into ascites broth and kept at 37° C. It is therefore not difficult to obtain the virus of measles unmixed with other microbes and in such form that it may be studied by various methods.

F. P. UNDERHILL.

**On the Tetanic Element in Bile.** BY S. J. MELTZER AND WILLIAM SALANT. *Proc. Soc. Expt. Biol. and Med.*, 2, 54–55.—The toxic effect of bile from normal rabbits shows an individual variation: the effect of the bile from some animals is predominantly coma, and from others tetanus. Heating the bile seems to reduce the stupefying, paralyzing effect, and to favor the appearance of the tetanic element. In the bile of nephrectomized rabbits the tetanic element was distinctly more pronounced than in the bile of normal animals.

F. P. UNDERHILL.

**Radium and Some Methods for its Therapeutic Applications.** BY HUGO LIEBER. *Proc. Soc. Expt. Biol. and Med.*, **2**, 32–37.
F. P. UNDERHILL.

**Gelatin as a Substitute for Protein in the Food.** BY J. R. MURLIN. *Proc. Soc. Expt. Biol. and Med.*, **2**, 38–39.—See this Review.
F. P. UNDERHILL.

**The Reductions in the Body in Fever.** BY C. A. HERTER. *Proc. Soc. Expt. Biol. and Med.*, **2**, 39.—See this Journal **27**, R 164.
F. P. UNDERHILL.

**The Measurement of the Reducing Processes of Cells in Vitro.** BY C. A. HERTER. *Proc. Soc. Expt. Biol. and Med.*, **2**, 39–40.—An apparatus was demonstrated which had been devised for the purpose of measuring the reducing processes of the different kinds of cells *in vitro*. Definite quantities of the pulp of the organ under investigation were placed in specially constructed tubes, and anaerobic conditions were established by the passage of nitrous oxide gas. Definite quantities of methylene blue of known strength were then added. The rate of reduction was indicated by the disappearance of the blue color, owing to the reduction of the methylene blue by the animal cells.
F. P. UNDERHILL.

**Some Medical Applications of the Naphthoquinone Sodium Monosulphonate Reactions.** BY C. A. HERTER. *Proc. Soc. Expt. Biol. and Med.*, **2**, 40–41.—Among the biological and medical applications mentioned for naphthoquinone compounds are the study of various aromatic compounds in the organism. The occurrence of certain intravital syntheses, the detection in the urine of organic compounds, such as paraaminophenol, and the development of a method of staining the bile capillaries by means of intravenous infusion of the derivatives of the naphthoquinone compound. These substances also facilitate the study of the relation between chemical constitution and the distribution of poisons in the body.
F. P. UNDERHILL.

**On the Rate of Absorption from Intramuscular Tissue.** BY S. J. MELTZER AND JOHN AUER. *Proc. Soc. Expt. Biol. and Med.*, **2**, 41–42.—See this Journal **27**, R 277.
F. P. UNDERHILL.

**The Protective Action of Venom upon Blood Corpuscles.** BY HIDEYO NOGUCHI. *Proc. Soc. Expt. Biol. and Med.*, **2**, 43.—That concentrated solutions of venom fail to destroy and tend to preserve blood corpuscles was noted by Mitchell and Stewart. Among the recent writers who have paid special attention to the interpretation of this phenomenon are Kyes and Sachs. They ascribe it to deviation of the hemolytic complement through the excess of venom amboceptors. The study which forms the basis of this communication shows the hypothesis of Kyes and Sachs

to be untenable, since it can be demonstrated that (1) the protective action fails to occur with venom in which, through heating to 95–100° C., the hemolytic principle has been preserved, but certain other constituents have been coagulated, and (2) the action extends to protection of the corpuscles from laking by water, ether, saponin, etc. The conclusion which has been reached by the author is that venom unites with the globulins and especially with the hemoglobin of the red corpuscles, yielding a water-insoluble compound to which the protection is due. Various substances, such as salts, acids and alkalies, restore the hemolyzability of the corpuscles by dissolving the venom-hemoglobin compound. The permeability of the corpuscles is not markedly altered. F. P. UNDERHILL.

**Preliminary Communication on the Composition of the Liver after Subcutaneous Injections of Liver Extracts.** BY P. A. LEVENE AND L. B. STOOKEY. *Proc. Soc. Expt. Biol. and Med.*, **2**, 20.—When rabbits are treated with saline liver extracts the autolytic powers of the livers of such animals are not diminished by such treatment. It was also noted that the organs of the treated animals contained smaller proportions of nitrogen than the livers of the control animals, and further, that the proportions of non-coagulable proteins and of non-basic nitrogen were higher than in the controls. The ether extracts of the livers of the treated animals were higher than in the control livers.

F. P. UNDERHILL.

**On the Decomposition Products of Epinephrin.** BY JOHN J. ABEL AND R. DEM. TAVEAU. *Proc. Soc. Expt. Biol. and Med.*, **2**, 30–31.—Among the decomposition products of epinephrine, the alkaloid, and epinephrine hydroxide is the basic substance, $C_3H_4N_2O$, which is obtainable equally from both forms. On treatment with caustic potash, ammonia, methylamine, and methylhydrazine results. Of these products methylamine is also obtained from both modifications of epinephrine, but methylhydrazine has not been obtained from either.

F. P. UNDERHILL.

**Physiological and Pharmacological Studies of Magnesium Salts. I. General Anaesthesia by Subcutaneous Injections.** BY S. J. MELTZER AND JOHN AUER. *Am. J. Physiol.*, **14**, 366–389.—It has been found that in the various experimental animals, rabbit, cat, dog, guinea-pig, white rat, frog, and fowl, a certain dose of magnesium sulphate will produce a deep, and often long-lasting anesthesia with complete relaxation of all the voluntary muscles and abolition of some of the less important reflex activities, which anesthesia terminates in perfect recovery. A larger dose of magnesium salt will produce a profound anesthesia and general paralysis which leads sooner or later to a calm death

without being preceded or accompanied by any symptoms of excitation. F. P. UNDERHILL.

**The Excretion of Acetone and Diacetic Acid in a Case of Pernicious Vomiting of Pregnancy.** BY HELEN BALDWIN. *Am. J. Med. Sci.*, **130**, 649–652.—The author shows that in a case of pernicious vomiting in pregnancy there was a large excretion of acetone and of diacetic acid. Also that the products of intestinal putrefaction were present in the urine in large amounts.

F. P. UNDERHILL.

**The Effect of Experimental Conditions on the Vascular Lesions Produced by Adrenalin.** BY LEO LOEB AND THOMAS C. GITHENS. *Am. J. Med. Sci.*, **130**, 658–670.—Removal of the thyroid glands in rabbits does not prevent the toxic action of adrenaline on the aorta. Interference with renal function by occluding ureters with subsequent injection of adrenaline does not increase the toxic action of the latter. Adrenaline injections do not interfere with the course of pregnancy or delivery in rabbits. They have no effect on the development of the vascular system of the fetus. It seems probable that pregnant animals are less susceptible to the toxic action than are others.

F. P. UNDERHILL.

## SANITARY CHEMISTRY.

**Purification of Water by Copper Sulphate.** BY DANIEL D. JACKSON, Chief Chemist, Department of Water Supply, Brooklyn, N. Y. *Municipal Engineering*, **29**, 245–246.—An account of experiments made with copper sulphate at Baisley Pond, L. I., Prospect Park Pond, Brooklyn, and in ponds connected with the Brooklyn Supply, also experiments made on bacillus coli, and the typhoid bacillus. The conclusions drawn by the author are as follows: The treatment of park ponds and reservoirs has demonstrated this as a satisfactory and thoroughly practical method of removing green growths, which produce unsightly appearance or disagreeable tastes or odors. One in 2,000,000 is sufficient for the removal of all objectionable growths. Virulent fresh typhoid fever germs require 1 to 50,000 to kill the germs, but 1 part of copper sulphate in 1,000,000 parts of water can be detected by taste and might affect the consumer. In case of a typhoid epidemic the bacteria may be greatly attenuated and rendered much less dangerous by a 1 to 1,000,000 solution.

LEONARD P. KINNICUTT.

**Copper Sulphate as a Germicide. Some Notes on its Influence with Sewage Effluents.** BY GEORGE A. JOHNSON AND WILLIAM R. COPELAND. *J. Infectious Diseases, Supplement No. 1,*

May, 1905, 327–331.—In testing the germicidal power of different concentrations of copper sulphate, a solution of the commercial salt was added in proportion of 1 part of the chemical to 200,-000, 100,000, 50,000 and 25,000 parts of sewage effluents. To some of the samples large numbers of typhoid bacilli were added before introducing the copper sulphate. The experiments were conducted with 100-cc. samples, and the effect of time and temperature, and also the effect of organic matter and carbonates on the action of the copper sulphate were studied. The general result was that the germicidal action of the copper sulphate increased with concentration of the solution, and that complete sterilization was not effected in any case in twenty-four hours, that at a temperature of 20° the bacteria disappeared more rapidly than at 5° C., and that the presence of carbonates and organic matter diminished the power of the copper sulphate. The results obtained by different degrees of concentration are given in the following table:

GERMICIDAL EFFECT OF VARIOUS CONCENTRATIONS OF COPPER SULPHATE.

| Parts of copper sulphate to parts of sewage effluent. | Bacteria per cc. | | |
|---|---|---|---|
| | Before adding copper sulphate. | Three hours after adding copper sulphate. | Twenty-four hours after adding copper sulphate. |
| 1 to 200,000 | 1,400,000[1] | 120,000 | 1,100 |
| 1 to 100,000 | 1,400,000[1] | 28,000 | 650 |
| 1 to 50,000 | 1,400,000[1] | 20,000 | 600 |
| 1 to 100,000 | 240,000[2] | 150,000 | 800 |
| 1 to 50,000 | 240,000[2] | 84,000 | 250 |
| 1 to 25,000 | 210,000[2] | 33,000 | 220 |

[1] Average of four sets of results.
[2] Average of three sets of results.

LEONARD P. KINNICUTT.

**Water Softening at Oberlin, Ohio.** BY W. B. GERRISH. *Eng. Record*, 52, 412 (1905).—A description of a water-softening plant at Oberlin. The water is very hard, owing to carbonates and sulphates of calcium and magnesium. Sodium carbonate and calcium hydroxide are added to the raw water. They are applied to the water in a mixing box 2 x 2 feet in section and 40 feet long, buried under ground, provided with baffle boards. The lime-water is admitted behind the first baffle, the sodium carbonate solution behind the second baffle board, and passes into the bottom of a settling basin of 330,000 gallons capacity, is drawn from the top of this reservoir and passed into at the bottom of a second reservoir of the same capacity. Each of the two settling basins contains twice the normal daily consumption, and at times when the consumption is only one-third the amount contained in one of the settling basins, permitting six days' sedimentation of the treated water before filtering, the best results are produced. The maximum amount of lime used in 1904

was 17 grains per gallon, of sodium carbonate 6 grains, the minimum amount 6 grains of lime and 2 grains of sodium carbonate per gallon. The alkalinity of the water is reduced from about 14 grains per gallon to 3 grains. The cost, including labor, interest and depreciation is about two and a half cents per 1,000 gallons of water. The bacterial efficiency of the process is said to be uniformly high. Tests extending over three weeks showed 90 per cent. purification and that the water as delivered contained on the average only 5 bacteria per cubic centimeters.

LEONARD P. KINNICUTT.

**Septic Tank and the Glover Patent.** *Eng. Record*, 52, 318.—The adverse decision of Judge Brown of the District Court of Rhode Island (this Journal, **26**, R, 521) was appealed to the U. S. Circuit Court of Appeals. The decision of the court written by Judge Colt confirmed the decision of Judge Brown, and defines the meaning of "septic tank," and "septic action" as follows: "that the fundamental condition which characterizes the septic tank, and which differentiates it from the ordinary settling tank, is that the sewage shall remain in the tank for a considerable period of time in order that the bacteria of putrefaction may manifest their destructive activity, and so accomplish their work of decomposition and liquefaction. The second essential condition which marks the septic tank is that the contents of the tank must either be practically cut off from all contact with the atmosphere, or the surface of the sewage must remain quiescent for a sufficient length of time to permit the accumulation of a thick scum on the top, which operates to exclude the air and light."

LEONARD P. KINNICUTT.

**The Chemical and Bacterial Composition of the Sewage Discharged into Boston Harbor from the South Metropolitan District, with Special Reference to Diurnal and Seasonal Variations.** BY C. E. A. WINSLOW AND EARLE B. PHELPS. *J. Infectious Diseases, Supplement No. 1*, May, 1905, pp. 175–208.—The paper is a result of studies made at the Sewage Experiment Station of the Massachusetts Institute of Technology which included daily analyses of Boston sewage extending over a period of nearly a year, and six special twenty-four-hour series of hourly analyses. The sewage studied was taken from the trunk sewer of the South Metropolitan District, a district which includes the city of Boston (with the exception of East Boston, Charlestown, and the harbor islands, the cities of Newton, Waltham and Quincy, and the towns of Brookline, Watertown, Milton, Hyde Park and Dedham). Owing to daily analyses not having been made in January, February and March, the records for seasonal variations are not as complete as might be desired and they are not of so much importance as the diurnal variations. The analyses, however,

showed a well-marked minimum of strength in May followed by a steady rise culminating in November or December. As to diurnal variations, Boston sewage was the strongest between the hours of 10 A.M. and 1 P.M., and it stands in relation to the average for the day as 1.25 to 1.00. This factor gives a means of correcting single samples taken each day between the above hours, so that they represent the average composition during the twenty-four hours. The average composition is shown in the following table:

BOSTON SEWAGE—AVERAGE COMPOSITION OBTAINED BY VARIOUS METHODS. PARTS PER MILLION.

| | Nitrogen as | | | | | | |
|---|---|---|---|---|---|---|---|
| | Albuminoid $NH_3$. | | | | | | |
| | Total. | Diss. | Susp. | Free $NH_3$. | Nitrites. | Nitrates. | Oxygen consumed. |
| Average of daily analyses | 6.2 | 3.1 | 3.1 | 19.9 | 0.26 | 0.15 | 45 |
| Average of six twenty-four-hour runs | 4.8 | 2.6 | 2.2 | 12.5 | 0.09 | 0.68 | 42.9 |
| Representative analysis corrected by factor for diurnal variation | 5.0 | 2.5 | 2.5 | 15.9 | — | — | 36 |

The figures for the nitrogen as nitrites and nitrates could not be corrected by using the factor 1.25 as their diurnal distribution is quite different. The nitrogen as nitrates is four times as high in the twenty-four-hour runs as in the regular daily analyses, while the nitrites are much lower. The authors explain this by saying that nitrates are most abundant during the night hours, when the sewage contains free oxygen. During the day, when organic matter is present in large amount, the nitrates are reduced, appearing in part as nitrites. Bacteriological analyses were only made on the six twenty-four-hour runs, and not on the daily samples. Enormous diurnal variations are shown in warm weather, the maximum number per cubic centimeter occurring not when the organic constituents are the highest, 11 A.M., but from four to six hours later. The seasonal variations were also very marked.

TWENTY-FOUR-HOUR RUN—AVERAGE NUMBER OF BACTERIA PER CUBIC CENTIMETER.

| | Lactose gelatine at 20°. | Lactose agar at 37°. | Anaerobic lactose agar at 20°. |
|---|---|---|---|
| July 22–23 | 4,710,000 | 3,733,000 | 2,010,000 |
| Aug. 13–14 | 2,465,000 | 1,195,000 | 1,410,000 |
| Nov. 16–17 | 272,000 | 288,000 | 1,188,000 |
| Dec. 22–23 | 200,000 | 234,000 | 625,000 |
| Feb. 16–17 | 261,000 | 156,000 | 294,000 |
| Apr. 12–13 | 477,000 | 806,400 | 231,310 |

The paper concludes with a table showing the total amount of nitrogen in its different forms in Boston sewage and gives as grams per capita daily, nitrogen as free ammonia 9.89, nitrogen as albuminoid ammonia 1.8, half of which is in solution, half in suspension and the oxygen consumed as 27 grams.

LEONARD P. KINNICUTT.

**The Determination of the Organic Nitrogen in Sewage by the Kjeldahl Process.** BY EARLE B. PHELPS. *J. Infectious Diseases, Supplement No. 1*, 1905, pp. 255–272.—The process for the determination of the organic nitrogen recommended by the author in 1903 (*J. Infectious Diseases, Supplement No. 1*, p. 327; this Journal, **26**, R 262) failing in certain cases to give reliable results, an experimental study of the Kjeldahl process and its modification was undertaken by Mr. Phelps. His experiments seem to show that chlorides, nitrites and nitrates in amounts found in sewage cause no serious loss of nitrogen, but he believes that the addition of a strong oxidizing agent as potassium permanganate, potassium bichromate or aqua regia before digestion is completed, does cause a decided loss of nitrogen, but does not if added after the digestion is completed. He also proposes the substitution of copper sulphate for mercury, as it avoids the subsequent addition of sodium sulphide. The method proposed as a result of his study is in outline as follows: One hundred cc. are placed in a digestion flask and 5 cc. of sulphuric acid and 0.1 gram of copper sulphate added, and the digestion allowed to proceed until the yellow color of the contents of the flask has entirely disappeared, when small crystals of potassium permanganate are added, one at a time, till the green color of the precipitate is permanent. The contents of the flask, when cold, are made up to 500 cc. with ammonia-free water; 10 cc. or more according to the nitrogen content of the sample are taken and diluted with an equal amount of ammonia-free water, and made strongly alkaline by the addition of an amount of a saturated solution of sodium carbonate equal to half the amount of the acid mixture, and 50 cc. are distilled over by blowing steam through the solution. The ammonia is determined in the distillate in the usual manner by nesslerization.

LEONARD P. KINNICUTT.

**Progress of the Sewage Works and Water Softening and Purification Works of Columbus, Ohio.** BY JULIAN GRIGGS, Columbus, Ohio. *Eng. News*, **54**, 313–314.—As the result of the experiments on sewage purification which have been carried on during the past year (this Journal, **27**, R 48,) plans for the treatment of the sewage of Columbus, nominal flow 20,000,000 gallons per day, have been presented to the State Board of Health. The method advised is percolating filters preceded by septic

tank treatment, the septic tanks to be uncovered, 12 feet in depth, with a total capacity of 8,000,000 gallons, the total area of percolating filters about 10 acres, made of broken stone, 5 feet in depth, laid in hollow, free draining bottom. The sewage is to be delivered from sprinkling nozzles 15 feet apart designed under a five foot head to spray the sewage on the surface of the broken stone at the rate of 2,000,000 gallons per acre per day. The effluent from the percolating filters to pass through settling basins, total capacity of 4,000,000 gallons. The water-softening and purification plant now being built and to be completed in November, 1906, consists of lime saturating tanks, mixing tanks, a settling basin in six compartments of 15,000,000 gallons capacity and ten mechanical filters each of a nominal capacity of 3,000,000 gallons, and a clear water reservoir of 10,000,000 gallons, together with chemical and bacteriological laboratories.

LEONARD P. KINNICUTT.

## INDUSTRIAL CHEMISTRY.

**Salt Cake and Muriatic Acid Manufacture by the Aehler-Meyer Process.** *Eng. Min. J.*, Sept. 23, 1905.—This process is the invention of Dr. Theodor Meyer (U. S. Patent, No. 702,877, June 17, 1902) and consists in heating an intimate mixture of equimolecular proportions of acid sodium sulphate and common salt. The substance has been previously ground to pass a sieve of 400 meshes per square centimeter. Because of the intimate mixing, the charge can be heated in closed muffle furnaces without stirring. The temperature is only 400° C., which leaves the resulting sulphate as a dry sintered mass and does not attack the bricks. The hydrochloric acid gas is very pure (practically free from sulphuric acid, chlorine and nitrous oxide) and is easily condensed to strong acid by means of cooled water—the entire yield of acid may be of 38 per cent. HCl. The advantages claimed are the avoidance of nuisance from escaping fumes, acid of high purity and concentration, reduction in the wear and tear of the apparatus and economy in fuel and labor.

S. P. SADTLER.

**Raw Material for Niagara's Electrochemical Industries.** BY MORRIS M. GREEN. *Electrochem. and Metal. Ind.*, August, 1905.—The materials most largely used for the electrochemical industries at Niagara Falls are salt for making caustic soda, sand for the manufacture of carborundum, anthracite coal for making graphite, lime for bleaching-powder and calcium carbide, coke for carborundum and carbide.

*Salt.*—This comes from Warsaw, Retsof and elsewhere in the Genesee Valley, Western New York. The salt is evaporated

from the brines either in open pans, which produces a coarse-grained article, or in vacuum with the production of a fine-grained salt. In the open pans, or "grainers" 1300 pounds of bituminous coal of fair grade are required, and in the vacuum pans, 900 pounds to the ton of salt. Ordinary evaporated salts contain about 98.5 per cent. of chloride of sodium. With coal at $2.50 per ton the "grainer" salt costs about $2.12 (f. o. b. at works) and the vacuum salt $1.70 per ton. The freight rate from the Warsaw district is 80 cents per ton.

*Coke.*—As the impurities in coke require power for volatilization in making carborundum and calcium carbide, it must be as pure as possible. Connelsville beehive coke is used, averaging 90 per cent. fixed carbon. The cost at the ovens is $2.30 and with freight to Niagara would make $4.00.

*Glass Sand.*—Very pure sand must be used for the same reason that pure coke is used. The Carborundum Co. gets its sand from Wedron, Ill., a distance of 600 miles. This has 99.5 per cent. $SiO_2$ and costs $3.50 per ton, of which three-quarters is freight charges.

*Anthracite.*—Egg size Lehigh coal is used for making artificial graphite. Costs $4 at the mines and $6 to $7 delivered.

*Lime.*—Only the purest is used, being made from limestone testing 99 per cent. $CaCO_3$. While pure limestone is quarried at a cost of 40 cents, $1 is charged for it, and 50 to 75 cents per ton of limestone for burning, making $3 or over as lime. Four dollars is the medium price at the kiln. S. P. SADTLER.

**A Brief Outline of Gasworks Chemistry.** BY H. B. HARROP, B.Sc., M.D. *Chem. Eng.*, September, 1905.—In the gas industry, the chief residuals are coke, tar and ammonia. The price, however, of the coke is about four times the sum of the tar and ammonia produced from the same coal. There are differences in the practice where the coke is obtained from coke ovens and from retorts. In the former system, where the coke is the prime object sought, the carbonizing period can be continued to minimize the sulphur content, while in retort practice the coke is secondary in importance, and other coals such as cannel, are mixed, which make the coke inferior, but improve the character of the gas. At the same time, the coking is not carried so far, so that less sulphur is obtained in the gas. The amount of coke obtained in the retort house is not the same as that from the laboratory tests. Where 35 per cent. of volatile matter is shown in the laboratory, less than 30 per cent. is frequently obtained in practice. The moisture in coke is an important consideration, as in the breeze it is considerable. The determinations of moisture, ash and sulphur are the most important. The methods for these are too well-known for comment here. Careful examination of the ash is sometimes made, and

where this is done, it is essentially the same as in the analysis of a clay. The method discussed by the author for the determination of the heat of combustion is that effected by the use of the Parr calorimeter. From the viewpoint of the gas works, very little attention is paid to the coal tar, except to sell it for uses such as the making of roofing papers, paving, coating wood and metal, and, to a small extent, for antiseptic preparations. Aside from these, however, tar has lately been coming into use as a fuel, for the reason that a very intense heat is obtained. So-called pitches are obtained by driving off the volatile constituents. This is sometimes done by the gas works, and sometimes by purchasers of the tar. In this way a product without water and volatile constituents is obtained. The purchasers of the tar distil it for benzene, toluene, naphthalene, etc., but, as the author says, little of their practice is understood by the gas works management. Where tar is distilled by the gas works, the points or regulations are obtained by rule-of-thumb methods. Care must be taken, towards the end of the distillation, however, that it is not pushed too far, so as to coke the residuum, as it is very hard to remove from the still if that is done. Determinations that are made of tar, mentioned by the author, are water and free carbon. The water is generally determined by distillation with or without the addition of benzene or light coal tar distillates, the amount of water being measured by volume in a graduated vessel used as a receiver. An interesting method, however, described by the author, is one in which metallic sodium is added to the tar, and the amount of caustic soda formed by the reaction between it and the water, is titrated with standard sulphuric acid. The free carbon is determined by the use of various solvents, such as carbon disulphide, benzene, etc., no one of which, however, leaves pure carbon, highlv condensed hydrocarbons being intermixed. S. P. SADTLER

**The Equipment of a Small Electrochemical Laboratory.** BY WM. HASTINGS EATON, PH.D. *Chem. Eng.*, September, 1905.

**Action of Acids on Iron and the Use of the Acid Pickle.** BY C. F. BURGESS. *Electrochem. and Metal. Ind.*, September, 1905. —The author discusses in a very exhaustive way the action of acids on metals, chiefly wrought iron, treating from the standpoint of the use of various acids, different grades of iron, the influence of impurities in the acids, the action of different temperatures. He considers the literature as of very little value heretofore, due to the fact that practically no quantitative results are recorded, and that, therefore, the impurities in the different solutions and metals used, make qualitative work valueless. The author is engaged in carrying out exhaustive experiments to clear up this field. To obtain an idea as to the great extent of the art of pickling, or what might be called the

pickling industry, he estimates that in the United States about 70 square miles of sheet iron are pickled for galvanizing, about 100 square miles of wire surface for a similar purpose, and 140 square miles for tinning in sheets, and besides this, a large amount of pickling for the drawing of wire, annealing and stamping in many cases, one important application being for the purpose of enameling, which has become a large industry. The author states that an ideal pickle for removing scale and rust would be one which removes the coating without attacking the underlying metal, but due to the fact that iron is attacked by all the known solutions more easily than the rather resisting scale, such a result is not likely to be attained. The action in pickling is due to the acid attacking the metal itself, and the scale is detached very largely because of the hydrogen formed, which quickly disengages it. The scale, when examined carefully, shows considerable porosity and cracks, which enable the acid to get in at many points; otherwise the disengaging of the scale would be very slow, and much metal would be consumed. The author finds a scale to be either ferric oxide, $Fe_2O_3$, or ferro-ferric oxide, $Fe_3O_4$, the latter oxide, however, being the more important. The author gives a large number of formulae for pickles used for removing scale and rust. He draws a distinction between two classes of baths: the dip, in which a practically concentrated acid is used, where it is desired to brighten the metal by the mere action upon the oxides, the concentrated acids not attacking the metal so readily; and the pickles, where diluted acids from about 3 per cent. to 20 per cent. in strength are used.

S. P. SADTLER.

**Action of Acids on Iron and the Use of the Acid Pickle.** BY C. F. BURGESS. *Electrochem. and Metal. Ind.*, October, 1905.—In this instalment, the author gives formulae for the use of hydrochloric and sulphuric acids, in which the action of the two is compared, and discusses the efficiencies, it being in the main shown that hydrochloric acid is more efficient, although less concentrated and costing more, due to the fact that the solution can be used through a much wider range, sulphuric acid becoming very inefficient after moderate usage. This does not mean, however, that it cannot be used in localities where sulphuric acid is very cheap as compared with hydrochloric acid. With regard to making use of the by-products, there is little promise of much being done, except where operations are carried out on a very large scale, due to the low market price of ferrous sulphate (copperas). The subject of impurities is discussed, and the author agrees with experience in the trade, that arsenic has a decided influence, which has led to a considerable use of brimstone acid. He is working upon the subject in his laboratory and believes he has found something that may be added to the

bath that will have the desirable effects of arsenic without causing a black deposit such as occurs with the use of arsenic. The author discusses the influence of impurities of iron with the acids. The free carbon generally forms a flocculent scum, the combined carbon giving rise to hydrocarbons by the action of the acids. It is found that the amount of residue left decreases with the concentration of the acids used. The use of the electric current has not proved of any advantage in pickling. Where the metal is made an anode in neutral solutions the scale is not loosened, due to the lack of liberation of hydrogen, while when it is the cathode, the hydrogen is liberated on the outside of the scale, due to the high conducting properties.

S. P. SADTLER.

**Sulphuric Acid Manufacture.** BY F. LUETY. *Eng. Min. J.*, October 7, 1905.—In this article, which is taken from the German, the author describes the method of manufacture of sulphuric acid, invented by H. H. Niedenfuehr.

Speaking of the general subject, the most important among the furnaces used are the Herreshoff, Humboldt and O'Brien, although when labor is cheap, hand-work furnaces are sometimes used by preference.

In the Glover tower there is a partition near the bottom, which allows of the cleaning of the packing at that portion from deposited fines. The Glover tower has been increased in efficiency by making it both higher and larger, and situated considerably above the level of the roasters in order to secure good drafts.

The Gay-Lussac tower consists of two or three towers with an aggregate capacity of 97,115 cubic feet per 50,000 kg. of chamber acid made, the last tower being filled with coke. The chambers are made high and narrow. To further increase the productive capacity of the chambers, a fan is placed preferably immediately after the roasters, except when fines are used, in which case it is placed between the Glover tower and the Gay-Lussac, or else between the first two Gay-Lussac towers. The use of atomized water is introduced instead of steam, care being taken that the water does not impinge directly upon the chamber walls. With these improvements, the normal production has been raised from 3 or 4 kg. per cubic meter of chamber space, to 6 or 7

In the process of H. H. Niedenfuehr, the inventor divides the Glover tower into halves, placing a fan between these. The gases at this point are not corrosive, and at the same time are free from dust. Besides this they occupy a smaller volume, making it easier to propel them. The fan then forces the gases from the second or denitrating part of the Glover tower, through the chambers, and the Gay-Lussacs. To completely denitrate

the acid in the Glover tower, a little steam is introduced which dilutes the acid to about 57° Bé.

The following advantages are claimed: The roasters are worked independently of the chambers and in this way can receive larger charges than previously, with uniform results; the consumption of nitre is very low, being from 0.6 to 0.7 of 36° nitric acid per 100 parts of 50° sulphuric, and partly due to the equal distribution of heat; the production per cubic meter of chamber space has run from 9 to 11.5 kg. of chamber acid.

The chambers of the Niedenfuehr' system resemble towers rather than block-shaped chambers, the gases being forced through them with a fan to prevent their rising.

With regard to cost of installation, the following is quoted:

(1) About 1,800 sq. m. (19,400 sq. ft.) land, 36,000 marks ($9,000).

(2) Buildings, about 78,000 marks ($19,000).

(3) Machinery, etc., 17,500 marks ($4,375).

(4) Roasters, dust chambers. elevator. rails and bin, 72,000 marks ($18,125).

(5) Chambers and towers, 116,000 marks ($29,000).

Total cost of installation, 320,000 marks ($80,000).

Reckoning amortization on the apparatus and buildings at 7½ per cent., and interest on invested captial at 5 per cent., gives annually 37,300 marks ($9,325), with a daily production of 50,000 kg. of monohydrate, or for 100 kg., 20.72 pfennigs (5.13 cents).

We have further:

| Per 100 kg. $H_2SO_4$. | Marks. | Dollars. |
|---|---|---|
| Cost of pyrites | 1.28 | 0.3200 |
| Nitric acid | 0.21 | 0.0525 |
| Power (for atomized water and pyrite burners) | 0.0307 | 0.0077 |
| Wages (3 marks a day per man) | 0.144 | 0.0360 |
| Repairs | 0.0667 | 0.0167 |
| Amortization and interest | 0.2072 | 0.0518 |
| Total | 1.9386 | 0.4847 |

We have then the cost of production of 100 kg. $H_2SO_4$ (exclusive of general expenses), 1.94 marks (48.47 cents), a reduction of almost 17 per cent., as compared with the figure of the estimate given in 1902 in the paper quoted. Substituting this value in the estimate (as given in 1902 for the cost of production of acid concentrated in Kessler pans), we have for 100 kg. of 66° acid (93 per cent. $H_2SO_4$), a first cost of 2.19 marks (54.75 cents).

S. P. SADTLER.

**Materials Used in the Construction of Filter Presses.** BY EMIL HATCHEK. *Electrochem. and Metal. Ind.*, June, 1905.—To withstand acids, and for the use where iron might corrode

and discolor pigments, such as white lead, wooden and lead-covered presses are used, the wood withstanding acids until they become moderately strong and imparting no color to such substances as mentioned, and the lead-covered iron presses being used for even strong sulphuric acid. Stop-cocks, feed inlets, etc., are made of gun-metal, hard rubber, etc. S. P. SADTLER.

**New Paint Conditions Existing in the New York Subway.** BY MAXIMILIAN TOCH. *J. Soc. Chem. Ind.*, May 31, 1905.—The author made analyses of rust found in the Subway, showing the light brown rust to be $Fe_2O_3,2H_2O$, and the blackish brown $Fe_3O_4,1H_2O$. He concludes, therefore, that this precludes the possibility of mill scale having caused the oxidation. The rusting was further shown to be very continuous, due to its porous character, and the fact that carbon dioxide with moisture would continually work in.

The author had shown, in a paper read before the American Chemical Society on March 20, 1903, that a dried film of linseed oil is not porous, but when subject to moisture forms with it a semisolid solution, the moisture being carried through the oil to the surface of the metal.

Measurements of vapor-pressure, humidity, and dew-point were made, showing that there was a continual tendency to a precipitation of moisture in the Subway, it being concluded from these main facts that a paint made with a pigment and linseed oil was not fit for subterranean work; a paint which would not saponify or hydrolyze would have to be used.

S. P. SADTLER.

## AGRICULTURAL CHEMISTRY.

**Concerning the Agricultural Value of Sodium Salts.** BY H. J. WHEELER AND G. E. ADAMS. *R. I. Agr. Expt. Sta. Bull. 106.*—This bulletin contains an account of the continuation of the work with sodium salts published in previous publications of the station. The crops grown were corn, radish, chicory, carrot, beet, summer squash and soy bean. Radish, chicory, carrot and beet were helped by sodium salts where fractional application of potassium salts had been made. In a study of the after-effects of sodium and potassium salts on clover, timothy and red top conducted on the same plots in 1902, 1903 and 1904 it was found that timothy and clover were both able to persist better where large application of these salts had been made, while the influence of large applications of potassium salts continued to the third year. Considerable evidence was obtained that the early applications of sodium salts increased the yield of hay in those cases where the applications of potassium salts had been large.

F. P. VEITCH.

**Plant Peculiarities as Shown by the Influence of Sodium Salts.** BY H. J. WHEELER, *R. I. Agr. Expt. Sta. Bull. 104.*—The experiments described were begun in 1894 and were conducted on 48 plots which received the same quantity of nitrogen and of phosphoric acid with different quantities of potassium salts and of sodium salts. In one series, these salts were in the form of chlorides and were used on unlimed and limed plots: in the other, carbonates of potassium and sodium were used on unlimed and limed plots. Of the plants grown, barley, beet, spinach, lettuce, pea-bean, turnips and rutabagas were helped more or less by liming, while lime was of doubtful value or was harmful to rye, golden millet, carrot and radish. Full rations of potassium salts greatly increase the yield of all crops. The presence of full rations of sodium salts and small applications of potassium salts were also decidedly helpful. The addition of full rations of sodium salts to fractional rations of potassium salts gave marked results only in the case of beets, turnips, radishes and rutabagas. It is concluded that sodium salts are often of value where the supply of potassium is quite limited but the manner in which they act is not understood. There are indications that they liberate phosphoric acid and conserve potassium and it is not unlikely that with a limited supply of potassium, sodium may aid in some degree in performing some functions of potassium.

F. P. VEITCH.

**A Discussion of Methods for the Estimation of Tannin.** BY F. P. VEITCH. *Bur. Chem., U. S. Dept. Agr. Bull. 90.*—This paper contains a brief general discussion of the hide powder method and of the recently proposed method of Rous (*Z. angew. Chem.*, **41**, 717), of Wislicenius (*Ibid.*, **25**, 801) and of Parker and Payne (*J. Soc. Chem. Ind.*, **23**, 648) and a statement of the author's experience with several of them. With the Rous method the author found that the weight of the precipitate and its iron content do not vary proportionately with the amount of tannin present in the solution and that with different tanning materials the proportion of iron present in the precipitate varies greatly. Precipitation of tannin appears to be complete. With the Parker and Payne method, complete precipitation of tannin was never obtained.

F. P. VEITCH.

**Experiments on the Volumetric Estimation of Potash as Phosphomolybdate.** BY M. G. DONK. *Bur. Chem., U. S. Dept. Agr. Bull. 90.*—The material to be analyzed is treated as usual, omitting the precipitation with ammonia and ammonium oxalate, to the point where after igniting to drive off ammonium salts the residue is taken up in dilute hydrochloric acid. Twenty cc. of a solution of pure phosphomolybdic acid (containing 100 grams per liter and acidified with 250 cc. of nitric acid of sp. gr. 1.42)

are now added and the whole evaporated to dryness on the water-bath. The mass is exhausted with 25 cc. of 0.5 per cent. nitric acid, warmed to 50° C., allowed to cool and washed three times by decantation with a 0.5 per cent. sodium nitrate solution and finally on an asbestos filter, using not to exceed 150 cc. of wash solution. The precipitate is dissolved in standard alkali (1 cc. N/10 alkali = 0.575 mg. $K_2O$) and titrated back with standard acid, using phenolphthalein as indicator. The results with chemically pure potassium nitrate, commercial potassium chloride and sulphate, tobacco dust and two mixed fertilizers were very satisfactory. The molybdate method gives slightly low results on the potassium salts. F. P. VEITCH.

**Nitrification and Soil Deficiencies.** BY G. S. FRAPS. *Bur. Chem., U. S. Dept. Agr. Bull. 90.*—The power of the native bacteria of different soils to produce nitrification of organic nitrogen in their respective soils was studied and it was found that calcium carbonate in nearly all cases increased the amount of nitrates produced in a given time but no relation could be traced between nitrification and acidity as determined by the Hopkins method. The varying nitrifying power is due in part to deficiency of calcium carbonate, phosphoric acid and potassium, while such deficiency of phosphoric acid is, as a rule, accompanied in the observed cases by a deficiency of phosphoric acid for corn and cotton. F. P. VEITCH.

**Address on the Rational Use of Fertilizers.** BY H. W. WILEY. 21st Annual Convention of the Association of the Official Agricultural Chemists. *Bur. Chem., U. S. Dept. Agr. Bull. 90.*—This is an address delivered before a joint meeting of the Association of the Official Agricultural Chemists and the Fertilizer Manufacturers Association in which the desirability of uniform fertilizer laws and the importance of manipulated fertilizers in agriculture are briefly and clearly pointed out.

F. P. VEITCH.

**The Estimation of Small Quantities of Phosphoric Acid by the Official Volumetric Method of the Association of Official Agricultural Chemists.** BY F. P. VEITCH. *Bur. Chem., U. S. Dept. Agr. Bull. 90.*—It is shown that as little as 0.5 mg. of phosphoric acid dissolved in 800 cc. of water may be carried through the several processes of this method with accuracy. With 0.1 mg. the results were high. F. P. VEITCH.

**Summary of Experiments on the Relation of Soil Acidity to Fertility.** BY F. P. VEITCH. *Bur. Chem., U. S. Dept. Agr. Bull. 90.*—All the more common field and garden crops as well as red clover and cowpeas were found to give larger yields on soils made alkaline with lime than the same soils when their acidity

was only partly neutralized. Tabulations of the results of the vegetation experiments of the Bureau of Chemistry extending through eight years show larger yields of oats, beans and buckwheat on alkaline than on acid soils and also a more economical use of plant food, with the exception of phosphoric acid, which was contained in greater proportion in crops grown on alkaline soils. The amounts of phosphoric acid and of potassium dissolved in N/200 acid were greater from alkaline than from acid soils. In six years, oats, followed by buckwheat, reduced the acidity of many soils, while beans followed by buckwheat increased the acidity of the same soils. Beans were not subject to fungous diseases on alkaline soils. No close relation could be traced between different soils of different acidity and crop yields, but the same soil of different degrees of acidity gave corresponding differences in crop yields. In general, the mechanical condition of the alkaline soils was better than that of the acid soils, the latter showing a decided tendency to water-log and rot the roots of plants grown in them. Nodules were more plentiful on legumes grown in alkaline soils. No definite results were obtained on the lasting effect of lime. Many experiments showed that no neutralizing effect was exercised by lime below the depth to which it was incorporated with the soil. The results indicate that alkaline soils are more fertile than acid soils and produce crops more economically than do acid soils; that in applying lime the soil should finally be made alkaline to the full plowed depth; that in ordinary farm practice the acids of the subsoil are not neutralized by applying lime. F. P. VEITCH

**Experiments on the Influence of Fertilizers upon the Yield of Timothy Hay when Grown on Dunkirk Clay Loam in Tompkins County, New York.** BY J. W. GILMORE AND S. FRASER. *Cornell Agr. Expt. Sta. Bull. 232.*—The average yield of oats on the unfertilized plots was 53.8 bushels per acre, on the fertilized plots 59.6 bushels. Nitrogen and phosphoric acid were most effective in increasing yields. The succeeding crop of timothy was markedly increased when nitrogen as nitrate or in stable manure was used. In nearly all cases fertilizers were used profitably on timothy but in no case were they profitable on oats. "Neither upon oats nor upon timothy did lime show any effect. It is true that in general the north end of each plot on which lime was applied seemed to produce better hay than the south end. ........ It was not deemed necessary to weigh the crop from the two ends separately." F. P. VEITCH.

**The Extraction of Tanning Materials with Different Extractors.** BY F. P. VEITCH. *Bureau of Chem., U.S. Dept. Agr. Bull. 90.*—In the comparison of the Weiss, or Soxhlet, Koch and a continuous extractor it was found that the continuous

extractor gave a more complete extraction of tannin in a given time than the others. The chief advantages of the continuous extractor are that no subsequent concentration of extract is required, and that as the tannin solution becomes concentrated it may be replaced by water, thus avoiding prolonged boiling of the extracted matter. No evidence was obtained that extraction was more incomplete at 100° C. or that more tannin was destroyed than at lower temperatures. F. P. VEITCH.

**Labels on Adulterated and Imitation Foods.** BY R. M. ALLEN. *Kentucky Agr. Expt. Sta. Bull. 119.*—The bulletin states in detail the influence that has been exerted on the labeling of foods by the Kentucky food law. Illustrations are given of attempts that have been made to evade the law, and suggestions for proper labeling are made. W. D. BIGELOW.

**Communication from the Laboratories and Scientific Station for Brewing.** BY DR. MAX WALLERSTEIN. *Third Annual Report,* July, 1905.—The publication includes the report of the biological laboratory with a discussion of results obtained from the examination of a number of products including water, wort, yeast and beer; the report of the analytical laboratory, which includes the results of the analysis of a wide variety of products of interest to the brewer and the discussion of the same; the report of the engineering department; and an article by Dr. Wallerstein on the relation of the proteids of barley to its malting qualities. This article discusses the European literature regarding the influence on the manufacture of beer of the nitrogen content of barley used in the preparation of malt, and includes the experience of the writer and of Dr. Wahl regarding the influence of the percentage of nitrogen in American barleys on the manufacture of beer. W. D. BIGELOW.

**Investigation Regarding Succulence.** BY FLOYD W. ROBINSON. *Mich. Agr. Expt. Sta., Special Bull. 32.*—In order to determine the influence of succulence on nutrition, a feeding experiment with cows was conducted. Several typical agricultural products were used as food. Special attention was given to wet beet pulp as a type of succulent food. The weight and composition of foods and excreta were determined, and these figures were used as data in determining the comparative digestibility of foods of different degrees of succulence. The results did not indicate any definite advantage in feeding the more succulent foods. W. D. BIGELOW.

**Manufacture of Dry Wines in Hot Countries.** BY FREDERIC T. BIOLETTI. *Cal. Agr. Expt. Sta. Bull. 167.*—The bulletin gives the information gathered on a visit made during the last vintage season to some of the chief wine-growing districts of

Europe and Algeria. Attention is mainly directed to those subjects which were expected to be of most immediate interest to the wine manufacturers of California. W. D. BIGELOW.

**Canned Fruit, Preserves and Jellies.** BY MARIA 'PARLOA *U. S. Dept. Agr., Farmers' Bull. 203.*—Detailed directions are given for the preparation of the articles mentioned in the title from ordinary commercial fruits. W. D. BIGELOW.

**Food Investigations.** BY V. K. CHESNUT. *Report of the Montana Agr. Expt. Sta. for 1904.*—Montana has no State law regarding the sale of foods other than meat and milk, and the work of the station on this subject was confined to those items and the work done in collaboration with the State veterinarian, who is charged with the enforcement of the meat and milk inspection law. A large number of meat preservatives were secured from local butchers, and sausage, that had been treated with the preservatives by butchers, was found to contain large amounts of sodium sulphite and borax. W. D. BIGELOW.

**Food Inspection.** BY CHARLES D. WOODS. *Maine Agr. Expt. Sta. Bull. 116.*—The bulletin contains the text of the food law enacted in Maine in 1905, and the standards of purity adopted for the State. W. D. BIGELOW.

**Maple Syrup and Sugar.** BY THOMAS MACFARLANE. *Inland Revenue Department, Ottawa, Canada, Bull. 102.*—Two collections of maple sugar and syrup were made; one previous to the maple sugar season in the spring of 1905, and another after the product of the season had been placed on the market. The samples on examination yielded results which caused them to be classified as follows:

| Collection. | Table. | | Genuine. | Doubtful. | Adulterated. | Total. |
|---|---|---|---|---|---|---|
| First | I. | Syrups | 17 | 4 | 76 | 97 |
| " | II. | Sugars | 12 | 2 | 8 | 22 |
| Second | III. | Syrups | 44 | 2 | 29 | 75 |
| " | IV. | Sugars | 15 | 0 | 3 | 18 |
| Total, | | | 88 | 8 | 116 | 212 |

From these figures it follows that in the first collection only 24.3 per cent. of the samples were found to be genuine, whereas in the second collection there was a great improvement, 63.4 per cent. being found to be genuine. W. D. BIGELOW.

**Macaroni Wheat.** BY JAS. H. SHEPARD. *S. D. Agr. Expt. Sta. Bull. 92.*—This bulletin is a continuation of Bull. 82, and was written to throw some light on the value of macaroni wheat as a bread wheat. The baker's sponge test and actual baking tests have been made with the various macaroni wheats and compared with those of some of the best South Dakota spring wheats.

Besides this, exact colorimetric determinations with the Lovibond tintometer were made on the flour, semolina, bread and macaroni. Tables showing the per cent. of protein and its distribution in the various mill products, the per cent. of moisture, and gluten, the baker's sponge test, the baking and macaroni tests, color, etc., are given. The results of the above determinations show that macaroni wheats vary greatly from each other. Some of them make bread scarcely equaled by the best of the bread wheats, while others make rather unattractive bread. Again, they are not all equally valuable in making macaroni. The work carried on leads one to expect that a macaroni wheat capable of "making a good macaroni, an attractive flour, and a bread that is satisfactory in loaf, color and flavor" can be produced. The wheats here examined were grown at Highmore, S. D., a semi-arid locality. From the results obtained, "it is plain that Kubanka No. 5639 is the best wheat milled, the bread wheats not excepted," the amount of flour being greater than that produced by Minn. No. 169 (Blue Stem), or N. D. Fife. The per cent. of protein ($N \times 5.7$) and the gluten content are also greater in flour made from Kubanka No. 5639 than from Blue Stem, Minn. No. 169. The per cent. of gliadin of the total protein is, however, greater in Blue Stem, Minn. No. 169 than in any of the macaroni wheats, the former reaching 66.8 per cent., the latter varying from 44.9 to 59.1 per cent. J. A. LECLERC.

**Winter Wheat.** T. L. LYON AND ALVIN KEYSER. *Neb. Agr. Expt. Sta. Bull. 89.*—Besides variety tests of wheat, this Bulletin contains a chapter on the "nature and causes of the yellow berry in hard winter wheat," in which it is found that the horny berries contain several per cent. more protein than the "yellow berry" from the same sample. The yellow berry has, therefore, less gluten and is poorer for milling purposes. The amount of yellow berry can be controlled to a large extent by early cutting and stacking. The bulletin likewise treats of the "variations in wheat from different regions and in different seasons," in which the changes in composition due to change in environment are noted. Dry seasons during the growing period are productive of wheat with high nitrogen content, and wet years produce a wheat low in nitrogen, but high in carbohydrates. When the nitrogen content is high, the date of ripening is early. The temperature and humidity, especially during period of growth after heading, influence the per cent. of nitrogen in wheat.

J. A. LECLERC.

**Report for 1904** *Ont. Agr. Coll. and Expt. Farm.* BY R. HARCOURT.—This report includes analyses of a number of different varieties of sugar-beets, showing that the average per cent. of sugar is highest in the Kleinwanzlebener, being 16.9 with a purity

coefficient of 88.1. In testing the quality of beets as affected by the distance between the rows, it is found that the best quality will be grown when the beets are sown in rows eighteen to twenty inches apart.

The report contains results showing the milling qualities of different grades of wheat, No. 1 hard and No. 1 Northern producing the largest per cent. of flour. The moisture and proteid ($N \times 5.75$) content, and the alcohol-soluble proteids vary as follows in the different grades of wheat.

| | Water. Per cent. | Proteid. Per cent. | Alcohol-soluble proteid of total proteid. Per cent. |
|---|---|---|---|
| No. 1 hard | 11.74–11.93 | 11.81–11.89 | 40.95–42.84 |
| No. 1 northern | 10.75–11.79 | 11.19–12.20 | 40.40–43.29 |
| No. 2 northern | 12.11 | 11.98 | 41.20 |

There is, therefore, no decided difference between the various grades. Analyses of the flours and the yield of bread from the different grades of wheat are also given. J. A. LECLERC.

**Directions for the Breeding of Corn, Including Methods for the Prevention of Inbreeding.** BY C. G. HOPKINS, L. H. SMITH, AND E. M. EAST. *Ill. Agr. Expt. Sta. Bull. 100.*—This bulletin shows that nine years of corn-breeding have proven the possibility of improvement in both yield and quality. "Examination of seed corn for improvement in composition may be made by mechanical methods." J. A. LECLERC.

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## PATENTS.

MARCH 28, 1905.

786,085. Oscar Bally, Mannheim, Germany. Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. **Violet anthracene dye.** $\beta$-aminoanthraquinone is condensed with glycerol in the presence of sulphuric acid. An olive-yellow powder soluble in concentrated sulphuric acid red-brown with green fluorescence, and on melting with caustic alkali gives a violet dye similar to indanthrene.

786,111. Barth Gollwitzer, Antwerp, Belgium. **Food compound.** Cow's milk 500, pig's blood 500, butter 150, sugar 150, calcium phosphate 50, boiled and chopped spinach 1000, and flour 4 parts to one of above mixture.

786,185. Henry S. Blackmore, Mt. Vernon, N. Y. **Metals and alloys.** The process of reducing aluminum and making alloys thereof which consists in fusing a bath of lithium oxide 4, calcium oxide 1 part, and adding an aluminate of the metal whose alloy is wanted, then electrolyzing the mixture.

786,243. James S. Barrett, Washington, D. C. Assignor to International Boiler Improvement Co., Pierre, So. Dakota. A current of air insufficient for complete combustion is passed through a bed of **fuel,** adding fresh fuel and reversing the air blast, and mixing steam and hot air with the products of incomplete combustion, preventing smoke and economizing fuel.

786,244. Henry S. Blackmore, Mt. Vernon, N. Y. Extracting **aluminum.** A fused bath of an oxy salt of aluminum and fluorine is electrolyzed at a voltage below that necessary to liberate fluorine, but adapted to set oxygen free in the presence of carbon.

APRIL 4, 1905.

786,348. Louis A. Dreyfus, New Brighton, N. Y. Assignor to Muralo Co., same place. **Paint.** Powdered gypsum or whiting 65, vaseline, glue and lime 10 each, all in powder. Casein (15 parts) may be used in place of glue.

786,359. Robert W. Hunt, Chicago, Ill. Perfecting **cast steel.** The mold is partially filled and a small steel rod set in the middle, whereby on filling the ingot mold the formation of a central cavity or "pipe," is prevented.

786,453. Wm. M. Mitschell, Louisville, Ky. **Inhaling compound** for firemen. Menthol 4, terebene 1, alcohol 8, and aqua ammonia 30 parts.

786,496. August P. Horn, Hamburg, Germany. **Neutral soap.** Albumoses as acid or alkali albumins are added to the raw soap stock, which is then worked up.

786,527. Heinrich Spatz, Schoneberg, Germany. **Rubber substitute.** Amber is dissolved in castor oil, the mixture is heated with sulphur, and through the product is passed a stream of ozone, the mass being finally treated with sulphur chloride and a solvent, and mixed with calcium carbonate.

786,534. John E. Thornton and Charles F. S. Rothwell, Manchester, England. Assignors to John Owden O'Brien, same place. **Photographic stripping film.** A transparent base of paper, a stripping medium of a resin salt of a fatty acid, a layer of insoluble gelatin and on this a sensitized emulsion.

786,535. As above for **photographic plate.** On one side is the sensitized emulsion, and the other side is coated with a developer and fixer over this with a protective coating.

786,536. As above, substituting paper for a rigid base.

786,556. Hermann Giessler and Hermann Bauer, Stuttgart, Germany. **Soap.** Add an alkaline perborate to an ordinary soap body, and a fatty acid.

786,561. Robert A. Hadfield, Sheffield, England. **Steel.** Contains carbon 0.44, manganese 0.32, nickel 3.5, and chromium 1.71 per cent.

786,570. Edward Kelly, Dover and Augustus Munson, Hibernia, N. J. Assignor to Joseph Wharton, Philadelphia, Pa. Treating **ore.** The ore is first screened to separate fines, the latter dried, and run through a magnetic separator of a certain power to separate all ore having a given per cent. of magnetite as heads, the tails being reduced and re-treated.

786,577. Albert L. Marsh, Lake Bluff, Ill. Assignor to Wm. A. Spinks and Co., Chicago, Ill. **Thermo-electric couple.** One element in whole or in part of cobalt and the other an alloy of nickel and chromium.

786,581. Harry E. Miller, Oakland, Cal. Process of **treating lead.** Ninety-five per cent. of the lead is oxidized to litharge, the residuum separated, and the litharge reduced to metallic lead.

786,595. Edward C. Paramore, Philadelphia, Pa. **Utilizing chlorine.** A chlorine generator is first cleared of air, the chlorine is passed through an electrolyzer between dielectric walls where it is treated with spark discharges and the liquid produced removed, the chlorine being used in bleaching solutions or solids, and the surplus or used gas is re-treated.

786,626. Charles H. Campbell, Philadelphia, Pa. Assignor to National Nutrient Co., Jersey City, N. J. **Concentrated milk.** Skim milk is heated in a blast of air and cream mixed with the concentrated skim milk, the mixture is subdivided and dried on extended surfaces.

786,629. Jens H. Christensen, Copenhagen, Denmark. **Matches.** The match stick is dipped in nitric acid, the excess of nitric acid removed by a solution of barium hydrosulphide and an igniting composition applied which is non-explosive.

786,640. Oscar Gros and Jakob Friedlander, Leipzig, Germany. **Catalyzing pictures.** A silver picture is treated with a ferrocyanide, and also a solution of a manganic salt, and an acid; the picture is then washed and exposed to the action of potassium ferrocyanide and sodium hydroxide. See No. 770,533.

786,767. Paul Julius and Ernst Fussenegger, Ludwigshafen-on-Rhine, Germany. Assignors to Badische Anilin und Soda Fabrik, same place. **Blue red azo dye.** Diazotized 3-4-6-dichloraniline is caused to react on $\beta$-naphtholdisulphonic acid R, making a dye soluble in water, adapted for lake colors, and on reduction with tin and hydrochloric acid yields the original components.

786,771. Valentine Lapp, Leipzig, Germany. **Non-alcoholic beer.** The yeast acts on the wort at 0°, the yeast is then removed when the wort becomes turbid, the liquid is clarified and carbonated.

APRIL 11, 1905.

786,814. Thomas Huntington and Ferdinand Heberlein, London, England. **Sulphide ores.** Previous to reduction they are heated and worked to remove a portion of the sulphur, rapidly cooled, combustion started again and desulphurized by blowing air through them.

787,001. Joseph Sanders, Washington, D. C. For composition of matter for **sound records** consisting of an oxide of the iron group 30, and a resinous substance as shellac or rosin 20 parts, to which 3½ parts of cotton or wool fiber may be added.

787,044. Samuel R. Kennedy, Philadelphia, Pa. Assignor to the American Dairy Products and Manufacturing Co., same place for **condensed milk,** differing from other condensed milks in having only a small proportion of sugar and salts.

787,046. August L. Laska, Offenbach-on-the-Main, Germany. Assignor to the firm of K. Oehler, Anilin and Anilinfarben-Fabrik, same place. **Claret-red mordant dye.** 2,6-Nitrodiazophenol-4-sulphonic acid is combined with cresotinic acid to form a yellow powder which, when dissolved in sulphuric acid, gives a reddish yellow that, treated with a chromium agent, turns to claret-red on wool.

787,103. Johann N. Ludwig, Mainz, Germany. **Photographic plates.** Exposed plates are treated with a substance adapted to absorb actinic light so as to permit of daylight development. Scarlet saffron 3B may be used.

787,170. Frederick H. Glew, London, England. For instrument to make luminous effects of **radio-active bodies** visible. It consists of an eye-piece, a radio-active substance, and between them a transparent body having a fluorescent surface which may be glass, mica, celluloid, etc., coated with glue and zinc phosphide or a similar phosphorescent substance.

787,221. A. S. Ramage, Detroit, Mich. **Aniline black.** An aqueous solution of a metallic salt as sodium chloride is electrolyzed with an insoluble anode and aniline sulphate producing aniline black, which is separated from the anode liquor, which is then used for making an additional supply of the aniline salt.

787,318. Wm. A. Lawrence, New York, N. Y. Assignor to Continental Rubber Co., same place. **Cleaning rubber.** The ground rubber is put in a hot water-bath where the rubber settles and the impurities rise to be skimmed off, then in a salt-water bath in which the rubber floats, and the impurities settle.

APRIL 18, 1905.

787,360. Max Engleman, Elberfeld, Germany. Assignor to Farbenfabriken of Elberfeld Co., New York. Making **dialkylbarbituric acid.** Dicyandiamide is condensed with dialkylated malonitriles by alkaline agents, and then treated with acids.

787,380. Charles B. Jacobs, Port Chester, and Robert Witherspoon, and Nathaniel Thurlow, Niagara Falls, N. Y. Assignors by mesne assignments to Cyanid Co., Jersey City, N. J. Making **alkali cyanides.** An alkaline earth cyanide and cyanamide are heated with an alkali carbonate. The alkaline earth and impurities are then removed by precipitation and cooling.

787,385. Herman Lentz, Philadelphia, Pa. **Insecticide** consisting of milk 120, turpentine 60, gasoline 20, creoline 8, oil of wintergreen 8, formalin 1, tartaric acid 30, and sulphur 8 parts.

787,458. Frederick W. Meeker, Rye, N. Y. **Artificial fuel.** A comminuted fuel, as coal, is mixed with a binding substance like resin and molded into briquettes.

787,541. Alexander S. Ramage, Detroit, Mich. Converting lead sulphate into **lead hydroxide.** Lead sulphate is acted on with excess of alkali hydroxide, the lead hydroxide removed, and the solution containing lead is made to react with another portion of lead sulphate to form basic lead sulphate, and the treatment with excess of alkali hydroxide repeated.

787,545. George W. Vanderslice, Clayton, N. J., and James E. Riley, Trenton, Mo. **Lubricants.** The resin is extracted from wood by immersing the wood in the form of sawdust in boiling petroleum, and said resin is combined with the oil, to make a lubricant, the wood being removed.

787,611. John L. Daniels, Jr., New York. Assignor to the American Cigar Co. **Treating tobacco.** A solution of sodium hyposulphite is applied to the tobacco which is then exposed to ozone.

787,758. Henri L. Herrenschmidt, LeGenest, France. Treating products containing **vanadium, molybdenum, titanium and tungsten.** The process is used to obtain vanadic acid from ores or products and is carried out by making a purified sodium vanadate solution, by evaporation and crystallization, precipitating by sulphuric acid, and reduction by a reducing agent to an alloy.

787,767. Paul Julius and Ernest Fussenegger, Ludwigshafen-on-the-Rhine, Germany. Assignors to Badische Anilin und Soda Fabrik, same place. **Azo dye.** Diazotized 3,4-dichloranilinesulphonic acid is combined with $\beta$-naphthol and the dyes have an orange-red color in the form of their barium-aluminum lakes, and on reduction with tin and hydrochloric acid regenerate the sulphonic acid and aminonaphthol.

787,768. Same. **Azo dye.** Obtained by combining diazotized 3,4-dichloraniline with $\beta$-naphtholdisulphonic acid R. The dye has a bluish red color in the form of its barium-aluminum lakes, and on treatment with tin and hydrochloric acid regenerates the constituents.

787,770. Paul Klein, Riga, Russia. Making **refractory articles.** Chrome ore is mixed with pulverized fire-clay and aluminum hydroxide, and after being molded and pressed is burned.

787,776. Otto Liebknecht, Frankfort-on-the-Main, Germany. Assignor to Roessler and Hasslacher Chemical Co., New York. **Antiseptic soap.** Ordinary household soap is melted and peroxide of zinc is stirred into it.

787,822. Matthew S. Bell, Mayfair, Transvaal. **Anti-incrustation fluid.** Made by boiling together in water 38 parts of black treacle, 19 wattle-bark, 9 shreds of leather, 4 licorice root, and 29 parts of caustic soda.

787,824. Rene Bohn, Mannheim, Germany. Assignor to the Badische Anilin und Soda Fabrik, Ludwigshafen-on-the-Rhine. **Black dyes** made by condensing naphthazarine with a sulphonic acid of an aromatic amine, as metanilic acid. A violet powder dissolving red in water, the solution turning violet on adding caustic soda.

787,859. Roland G. Scholl, Karlsruhe, and Oscar Bally, Mannheim, Germany. Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen-on-the-Rhine, Germany. **Anthracene compounds** called benzanthrones. An anthracene body is reduced with glycerol, which forms orange to green solutions in sulphuric acid, with green to red fluorescence, and on melting with caustic alkali the compounds yield violet-blue dyes.

787,869. Edward G. Acheson, Stamford township, Ontario, Canada. Assignor by mesne assignments to the North American Trust Co. **Refractory bodies.** A shaped material consisting of silicon, oxygen and carbon and a temporary binder is fired to form a coherent mass.

APRIL 25, 1905.

787,923. Albert Kann, Heidelberg, Germany. **Treating wool.** Wool is acted on by formaldehyde and then with a hot alkaline solution, producing a hardened elastic fiber that when treated with hot hydrochloric acid, dried and heated, emits an odor of formaldehyde.

787,926. Jean Lecarme, Paris, France. Treating **iron and steel.** Objects to be hardened are coated with a compound of charcoal, potassium cyanide and glue, then heated to a bright red out of contact with air.

787,928. Hugo Lieber, New York, N. Y. **Radio-active substances.** Cohesive matter is made radio-active by blowing thorium emanations into the matter, which may be water, the water being free from thorium, but saturated with its emanations, and radio-active by reason of the combination of the emanations of thorium with the particles of matter throughout its mass.

787,942. Theodore S. Pierce, Walla Walla, Wash. **Paving bricks.** Cement and slag one to four are made plastic by a solution of sodium silicate 15, litharge 2½, sulphuric acid 1, and water 320 parts.

787,973. Charles H. Burckett and Mary M. Burckett, Glenridge, N. J., said Charles H. Assignor to Mary M. Burckett. **Cocoa confection.** The cocoa beans are roasted, hulled, ground and boiled in water till the starch grains are broken, then digested with malt extract till the starch is converted into malt sugar, the mixture is boiled down with rapid stirring whereby the cocoa butter is emulsified with the other ingredients, then a diastatic ferment and sugar are added and stirred in, and the whole evaporated to proper consistency.

788,042. August Getz, San Francisco, Cal. **Sweeping compound.** Sawdust and silicious material, as sand, equal parts, a non-drying oil 15, rosin and pine tar 10 per cent each.

788,043. Francis X. Govers, Owego, N. Y. **Paper coating.** Saponified wax 20, casein 30, alkali 1, water 100, and a mineral base, as clay, 600 parts.

788,064. Alexander S. Ramage, Detroit, Mich. **Utilizing spent pickle.** Sulphur dioxide is dissolved in spent sulphuric acid pickle, the mixture electrolyzed with insoluble anodes, whereby the iron is deposited at the cathode and free acid liberated at the anode, the sulphur dioxide being oxidized and the regenerated liquor is re-used.

788,074. Christian H. Stoelting, Chicago, Ill. **Laboratory weights.** Adapted for the physical laboratory, having a hook at top, a flat bottom, and an eye in the bottom whereby they may be connected.

788,129. Alfred Becher, Bielefeld, Germany. **Transparent pictures** of celluloid. The plates are coated in the parts to remain free from color with a fatty substance, as printer's ink, and then painted with color that in addition to water or alcohol, contains acetic acid as a medium.

788,131–2. Guilford C. Glynn, Iola, Kansas. **Refractory material.** Dried kaolinite is pulverized and burned, in the presence of free air to eliminate organic matter and reduce the iron; then dump the product in a water-bath. The kaolinite consists of powdered aluminum 1, ferric oxide 3 parts, titanic ore of 60 per cent. 5, titanicoxide 4 parts, and a binding agent as ammonium chloride.

788,151. Thomas P. Hall, Chicago, Ill. Assignor one-half to Samuel T. Hutton, same place. **X-ray meter.** A screen and two movable measuring strips of different degrees of opacity for X-rays, and of different but gradually increasing opacity from one end to the other, have suitable gearing to cause the

strips to pass in combination before an opening in said screen and form a test of the intensity of the X-rays.

788,155. Oliver E. Horton, Jefferson, La. Composition for destroying **pear blight.** Peppermint oil 16, aqua ammonia 60, calomel 30, and linseed oil 1,000.

788,167. Thomas O'Brien and Wm. P. Long, Elwood, Ind. Assignors to American Sheet and Tin Plate Co., Pittsburg, Pa. **Coloring steel.** The metal sheets are packed in a closed receptacle, sealed with a permeable seal, made very hot, and then placed in shallow water that enters the box, finally removing and cooling box and contents.

788,216. Julius Moeller, London, England. **Bunsen burner for lighting and heating.** The burner consists of two annular tubes above the gas supply, which passes into the central tube, and the burner is provided with a mantle.

788,256. Hans Foersterling and Herbert Philipp, Perth Amboy, N. J. Assignors to Roessler and Hasslacher Chemical Co., New York, N. Y. **Oxygen** from alkali peroxide. A solidified fused mass of alkali peroxide is brought into contact with water.

788,273. Elise Marosi, New York, N. Y. **Hair tonic.** Infusion of half a pound of mustard seed in a pint of water, rosin a quarter pound, turpentine one pint, and lavender spirit and oil of lavender for perfume.

788,315. William Hoopes, Pittsburg, Pa. **Electrolytic separation.** A salt or ore of the metal is dissolved in liquid ammonia and the current passed through the solution. A porous diaphragm is used and the bath is kept anhydrous.

788,443. George H. Waterbury, Denver, Col. Assignor to Waterbury Metal Extraction Co. **Precipitating metals.** Copper is precipitated by pieces of aluminum, with agitation by air and steam.

788,446. Archibald R. Wilson, Hove, Brighton, England. Assignor to Albert Ernest Iveson, Gainsborough, England. **Cooling fatty substances.** Projects them in a fine spray by a cooled air-blast against a rotating drum.

788,480. Hugo Lieber, New York, N. Y. **Preserved food.** The food is made to absorb thorium emanations free from the thorium which has produced them, the said food becoming radioactive, and the emanations act as a preservative.

WM. H. SEAMAN.

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[R preceding a number or numbers refers to the Review of American Chemical Research. Pr refers to the Proceedings.]